

*BULLETIN*

*of the*

ILLINOIS NATURAL HISTORY SURVEY

HARLOW B. MILLS, *Chief*

# The Mosquitoes of Illinois

(Diptera, Culicidae)

HERBERT H. ROSS



Printed by Authority of the  
STATE OF ILLINOIS  
DWIGHT H. GREEN, *Governor*

DEPARTMENT OF REGISTRATION AND EDUCATION  
FRANK G. THOMPSON, *Director*



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HERBERT H. ROSS



*Printed by Authority of the State of Illinois*

URBANA, ILLINOIS

*August 1947*

STATE OF ILLINOIS  
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One of the largest Illinois mosquitoes is the "gallinipper," *Psorophora ciliata*, which may attain a wingspread of 15 mm. (over half an inch). It is a vicious biter and is generally distributed over Illinois. The larvae or wigglers of this species breed in rain pools and have the habit of feeding on larvae of other mosquito species.

# The Mosquitoes of Illinois

## (Diptera, Culicidae)

HERBERT H. ROSS

**M**OSQUITOES are midgelike insects of various sizes, some of them minute, some of them nearly a half inch long. They belong to the family Culicidae, which belongs to the order Diptera, embracing the common housefly and other two-winged flies. Mosquitoes have aquatic larvae called wiggle-tails, wigglers, or wrigglers, which transform to aquatic pupae called tumblers. The adults, which emerge from the pupae, are aerial.

About 150 species of mosquitoes are known to occur in the United States and Canada, and 52 of these have been taken in Illinois. The Illinois mosquito fauna represents a combination of the northern and the southern mosquito faunas, a combination not yet treated in the various reports giving keys to the faunas of limited regions.

Mosquitoes are a real nuisance in many parts of Illinois. Although some of the more intensively farmed areas are comparatively free from all but local incursions of mosquito broods brought on by unusual weather conditions, in all other parts of the state mosquitoes are a perennial problem. An extremely vicious biter, the salt marsh mosquito, *Aedes sollicitans*, has invaded a few Illinois cities. The malaria mosquito, *Anopheles quadrimaculatus*, is a menace to human health in some areas. To be economical as well as effective and thorough, a control program for these and other mosquitoes must be based on accurate identifications of the species involved and a knowledge of their peculiarities of life history and habits.

The nation's annual "mosquito bill" is high—probably \$100,000,000 due to mosquito-borne diseases, and close to \$50,000,000 for screening, pest control programs, and depressed real estate values.

The object of this paper is to provide means for making mosquito control programs more effective, first by furnishing illustrated keys and descriptions for the identification of mosquito species that occur in Illinois and states similar in climate, and

second by summarizing information regarding the distribution, biology, and habitat preferences of the species.

### BIOLOGY

Mosquitoes, in common with other groups of flies, have four distinct stages in their life history: (1) the egg, laid by the female; (2) the larva, wiggle-tail, wiggler, or wriggler; (3) the pupa, or tumbler; and (4) the adult fly.

#### Eggs

Eggs deposited by Illinois species of mosquitoes fall into three fairly distinct categories: (1) those laid singly on water; (2) those glued together in rafts that float on water; and (3) those laid singly in damp humus or other semidry material.

**Eggs Laid Singly on Water.**—In this category belong the eggs of *Anopheles*, fig. 1C. They are elongate oval, usually pointed at one end, and have a pair of lateral floats. From 100 to 300 eggs may be laid by an adult female after taking a blood meal; usually the eggs hatch in a few days. Little is known about the eggs of the tree hole genus *Megarhinus* except that they are laid singly on the surface of water. *Anopheles* and *Megarhinus* are the only genera in this class known to occur in Illinois.

**Eggs Laid in Rafts on Water.**—The eggs of many mosquito genera are deposited side by side in such a manner as to form a raft, fig. 1A. This raft floats on the surface of water, and the eggs hatch in a few days, each larva escaping from its egg at the end that touches the water. The raft may contain a hundred eggs or more. In the genera *Culex*, *Culiseta*, *Mansonia*, and *Uranotaenia*, eggs are deposited in rafts. The larvae of all these groups breed in permanent bodies of water.

**Eggs Laid Singly in Semidry Places.**—In many genera of mosquitoes, including *Aedes*, *Psorophora*, *Orthopodomyia*, and



*Wyeomyia*, the eggs are laid out of water, but they do not hatch until water has risen and inundated them. The eggs may be laid either just above the water line in such situations as tree holes, various water containers, and marsh edges, or in damp humus in the bottoms of recently dried-up pools that are subject to periodic flooding. The eggs of *Aedes*, fig. 1B, and *Psorophora*, normally

known as *intermittent breeders*. They include all species of *Psorophora* and certain species of *Aedes*: *vexans*, *solicitans*, *trivittatus*, and many southern species. In the other class, called *annual breeders*, because only one generation is developed each year, the eggs must be subjected to winter freezing before they develop. Eggs laid by the adults of one generation do not hatch with

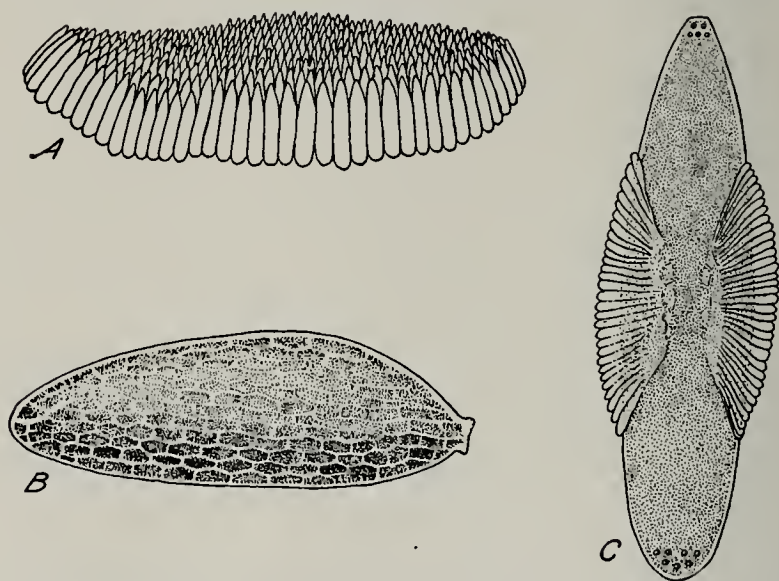


Fig. 1.—Eggs of mosquitoes: A, *Culex restuans*; B, *Aedes taeniorhynchus*; C, *Anopheles quadrimaculatus*. (After Howard, Dyar, & Knab.)

laid in damp humus, are adapted to withstand desiccation and may lie dormant 1 or 2 years without losing their viability. *Wyeomyia* lays its eggs above the water line in the pitcher plant, and these eggs do not hatch until the water within the pitcher rises. The same habit is a characteristic of the tree-hole mosquitoes, *Orthopodomyia* and *Aedes triseriatus* and *aegypti*, which lay eggs on the sides of tree holes or water containers just above the edge of the water so that with a rise in the water level the eggs hatch.

The species of *Psorophora* and *Aedes*, which lay their eggs out of the water, may be divided into classes with respect to significant differences in egg hatching. In one class the eggs hatch as soon as they are flooded; since in this species the life history is completed rapidly, several generations usually are produced in a summer as pools dry and flood with alternate dry and rainy periods. Species belonging to this class are

summer flooding but lie dormant through the winter and hatch the next spring. To this class belong many species of *Aedes*, such as *grossbecki*, *stimulans*, and *implacabilis*.

### Larvae

The mosquito larva or wriggler, fig. 2, has a distinct head, broad thorax, and tubular abdomen. It lives only in water. The larval period is one of feeding, during which the small larva hatching from the egg grows to a size large enough to produce the adult fly. Unlike the adult, this larva has no beak and does not suck food; instead it has a series of brushlike rakes in addition to the grinding and grasping mouthparts, a combination enabling it to strain, scoop, and ingest small aquatic organisms and particles of plant or animal matter floating in or upon the water or resting on the bottom. In the



few genera in which the larvae are predaceous on other mosquito larvae, the mouthparts are sharp-toothed for grasping and swallowing the prey.

Unlike fish, the wriggler does not obtain oxygen from the water by means of gills. When in need of air, the larva in most species swims upward until it is just below the surface of the water, if it is not already there, and sticks the breathing apparatus (in some species a tube and in others a plate), which is near the end of the abdomen, through the surface tension membrane into actual contact with the air, fig. 2. With the larva in this position, the air inside the body is exchanged for fresh air above the water. Among Illinois mosquitoes, only the larva of *Mansonia* does not come to the surface for air. In this species, fig. 18, the air tube forms a sharp, piercing organ, which is thrust into the air chambers in the underwater portions of marsh plants such as the cattail. The larva of *Mansonia* obtains its oxygen entirely from this source.

The larvae of Illinois mosquitoes may be divided into two distinct types on the basis of breathing structures and feeding habits, the anopheline type and the culicine type. In the anopheline type (including only the genus *Anopheles*), the larvae normally rest parallel to the surface, touching the surface tension membrane, fig. 2A. They have no air tubes; the spiracles form a flat structure on the back of segment 8. The larvae normally twist their heads through a 180-degree angle and feed on microorganisms or other particles at or on the surface, but occasionally feed below the surface much as do culicine larvae. When disturbed they swim to the bottom and hide. In the culicine type, the larvae normally feed on or near the bottom and come to the surface only periodically for air. This group includes all of the Illinois mosquitoes except *Anopheles*, and all of them have distinct air tubes. The predaceous species, such as *Psorophora ciliata*, do not feed on bottom microorganisms but usually cruise near the bottom and grasp their prey

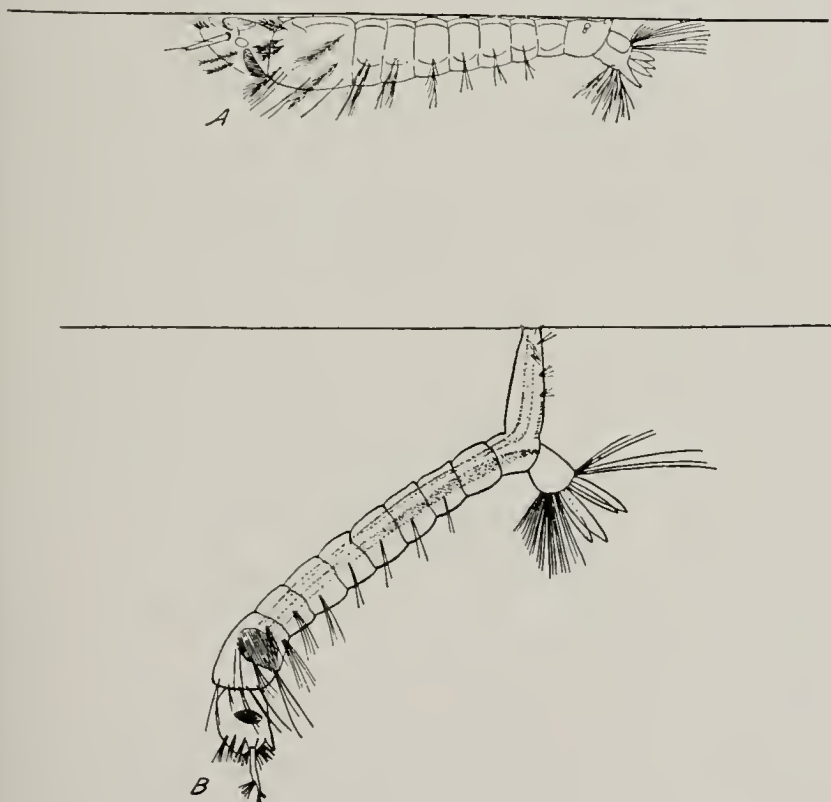


Fig. 2.—Larvae of mosquitoes: A, *Anopheles*; B, *Culex*. (After King, Bradley, & McNeel.)

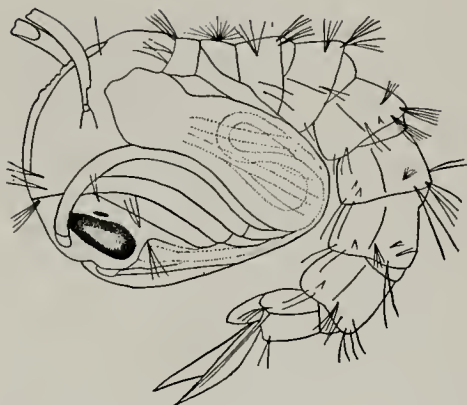


Fig. 3.—Pupa of mosquito. (After King, Bradley, & McNeel.)

there. The curious genus *Mansonia* is also included in this group although, as mentioned above, it does not come to the surface for air. It is a true bottom feeder.

### Pupae

The pupae do not feed but they breathe in the same manner as the larvae; the air tube is situated on the thorax, fig. 3, instead of near the end of the abdomen as in the larvae. The pupal stage, in which the muscular and other body structures of the larva

are broken down and reorganized into the structures of the adult, generally lasts only a few days. At the end of that time the mature pupa comes to the surface of the water, and the adult within it breaks the pupal skin, crawls out onto the surface of the water, and flies away.

### Adults

Mosquito adults, fig. 4, are fairly small, delicate, winged flies, quite slender, and always with long, spindly legs. All the adults of the true mosquitoes have beaks. The visible part of the beak is a scabbard or sheath in which a group of extremely fine stylets makes up a needle-like piercing and sucking organ; it is the function of the sheath to keep this slender needle straight when it is thrust through the skin of the animal upon which the female mosquito feeds. Both males and females fly with a distinct humming or buzzing sound.

Only the female mosquito "bites," or feeds upon animals; the male feeds on nectar and water. Whereas the female seeks out her prey and may travel long distances to it, the male is relatively inactive, generally hiding in grass or shrubbery except during the mating flights. There is evidence that the female does not bite for several



Fig. 4.—Adult of *Aedes aegypti*. (From photograph, loaned by the U. S. Public Health Service of model in the American Museum of Natural History.)

days after she becomes an adult. Not all species bite humans. Some feed on nectar, and it is thought that a few others feed chiefly either on plant juices or the blood of birds and small mammals.

Females of most species seek their blood meal during the dusk and night periods. Many of these same mosquitoes attack readily in the late afternoon or on cloudy days and during the dawn period. The woodland species almost invariably bite throughout the day, although their attacks are usually most vicious during the crepuscular period. A few species attack readily in the open during the day time. Probably the best known Illinois species having this habit is *Anopheles walkeri*. Of unusual interest is the biting habit of *Psorophora cyaneescens*, which attacks in the open and during times of bright sunlight.

Flight habits of mosquitoes have been the subject of considerable study, in which marked or colored specimens have been released and their recovery in light traps or resting places has been plotted. A species of mosquito apparently will behave differently under different conditions. It is usually considered that malaria mosquitoes normally have a flight range of not more than 1 or 2 miles. Probably the longest flight ranges occur in species of *Aedes*. It is not unusual for summer swarms of *Aedes vexans* to migrate 2 or 3 miles and possibly up to 15 miles, and the salt water mosquito, *Aedes sollicitans*, has been known to migrate 40 or 50 miles. Many woodland species appear to be fairly restricted in their movements and seldom leave the piece of woods in which they have matured.

The length of life of adult mosquitoes is not well known. Some of the *Anopheles* and *Aedes* females undoubtedly live 1 or 2 months during the summer period. The adults that hibernate have a much longer life span.

### Hibernation

The great majority of Illinois mosquitoes, including most of the species of *Aedes* and *Psorophora*, hibernate in the egg stage. A few species, such as *Wyeomyia smithii*, *Anopheles barberi*, and species of *Orthopodomyia*, hibernate as larvae frozen in pitcher plants or tree holes in which they breed. *Anopheles*, *Culex*, and at least *inornata* of *Culiseta* overwinter as fertilized females.

The males die with the advent of cold weather. The females hide in hollow trees, cellars, manholes, and other sheltered places, from which they emerge in spring and lay eggs.

### Habitat Preferences

The various species of mosquitoes differ greatly in the type of habitat frequented by the larvae. Some species breed in a great variety of situations, whereas others are extremely restricted in their breeding places. The following summary outlines in a general way the habitats preferred by the Illinois species.

**Running Water.**—*Anopheles punctipennis* usually breeds in small streams, frequenting the edges and shallow areas where the current is sluggish. This species breeds with equal success in still water. A few species of *Culex* sometimes breed in moving water heavily laden with organic matter where the current is slow. These same species normally breed in still water.

**Still Water.**—All Illinois species will breed in still water, and most of them only in still water, chiefly small ponds and pools of many types, the shallow edges of lakes, and the still water in shallow, dense weed beds along the edges of streams. Still water habitats are of several types and may be classified as permanent, temporary, specialized, and semidomestic areas.

**PERMANENT AREAS.**—All species that lay eggs on the surface of the water, whether singly or in rafts, frequent permanent water areas. All prefer areas with shallow water and little wave action, abundant cover in the form of at least moderate aquatic vegetation, and abundant food in the form of humus or other organic matter on the bottom and floating particles or microorganisms at the surface. Marshes, fig. 5, or shallow ponds with cattails, sedges, and associated aquatic vegetation are ideal for many mosquito species.

**TEMPORARY AREAS.**—In this category are ponds that fill with water intermittently for variable periods. In all these ponds one of the chief requirements for a good mosquito habitat is that they have ample organic matter (usually in the form of rotting leaves) on the bottom.

In Illinois, temporary ponds are extremely varied with respect to how and when they are filled, where they are situated, and how





Fig. 5.—Marsh near Hinsdale, Illinois. In spring the more abundant mosquitoes at the marsh edge include *Culiseta inornata*, *Aedes fitchii*, *Aedes vexans*, and *Culex apicalis*.

long they last. Most of them fall into one of four classifications: winter seepage ponds, flood plain ponds, summer rain ponds, and marsh edges.

Winter seepage ponds fill up during the winter or early spring with surface or seepage water from winter precipitation or the spring thaw. Ponds of this type, fig. 6, may have water in them for several months, but during much of this time the weather is too cold to allow mosquito development. They support many of our most vicious early spring *Aedes*, especially *canadensis*, *stimu-*

*lans*, *grossbecki*, and *implacabilis*. The same species occur in flooded stump holes, fig. 7.

Flood plain ponds form with the overflow and retreat of streams that leave isolated pools of water scattered throughout the flood plain. These are favorite places for many *Aedes*, especially the early spring species *sticticus*, and some *Psorophora* species.

Summer rain ponds form in many depressions during heavy summer rains and remain for periods of a few days or weeks. In these breed *Aedes vexans* and many species of *Psorophora*



Fig. 6.—Woodland pool, Bensenville, Illinois. This spring pool contains an enormous population of *Aedes stimulans*. It dries up in summer.

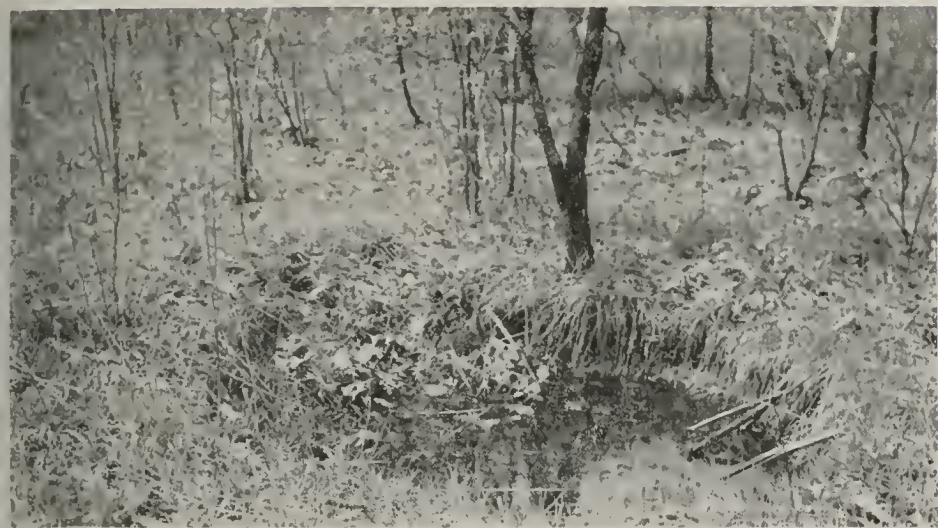


Fig. 7.—Stump hole, Bensenville. A favorite habitat of *Aedes canadensis*.

Marsh edges that are alternately flooded and exposed by the rise and fall of water give the same conditions as temporary ponds, as far as mosquitoes are concerned. These marsh edges or margins, fig. 5, are important mosquito breeding grounds, especially for *Aedes vexans*.

**SPECIALIZED HABITATS.**—Two situations of unique interest from the standpoint of the mosquito fauna are tree holes and pitcher plants. Each of these may harbor species of mosquitoes found in no other situation. Tree holes, fig. 8, include cavities within standing tree trunks and inside fallen trees (Jenkins & Carpenter 1946).

Illinois mosquitoes that are restricted to this habitat include *Megarhinus septentrionalis*, species of *Orthopodomyia*, *Anopheles barberi*, and *Aedes triseriatus*. The tree holes fill up either with rain water or with sap that has risen within the wounded tissues. Larvae that live in the tree holes develop much more slowly than is usual for species living in ponds. Only one Illinois species of mosquito, *Wyeomyia smithii*, breeds in pitcher plants; it is found in no other situation. Its larva feeds on decomposing animal material trapped in the pitcher.

**SEMIDOMESTIC SITUATIONS.**—Several species of mosquitoes breed readily in situations around human habitations. They breed in the water that accumulates in fish ponds, tin cans, or almost any other type of container, fig. 9. They may frequent also the accumulation in stopped-up eaves troughs, drains,

and cisterns. In Illinois the chief species found in these situations are *Culex restuans*, *pipiens*, and *quinquefasciatus*. In contain-



Fig. 8.—Tree hole at Starved Rock State Park. This is the habitat for *Aedes triseriatus*, *Orthopodomyia* species, and *Anopheles barberi*.





Fig. 9.—Refuse heap near Wilmette, Illinois. Water in the containers is a favorite breeding place for *Culex pipiens* and *restuans*.

ers that are out of doors and that have in them an abundance of organic material (neglected fish ponds are the favorites), *Anopheles punctipennis* may breed in enormous numbers. *Aedes aegypti* also breeds in similar containers, usually those inside buildings.

### SEASONAL DISTRIBUTION

The various mosquito species appear in a fairly definite sequence as the season advances. The earliest species are *Aedes*, whose larvae develop in the spring pools. In southern Illinois the principal species are *canadensis*, *grossbecki*, and *sticticus*, through the central part of the state *canadensis* and *sticticus*, and in the northeastern part *stimulans*, *implacabilis*, *fitchii*, and others. In southern Illinois the first emergence may occur as early as April 1, in northern Illinois by the middle of May, but usually first emergence is about two weeks later than these dates. The early *Aedes* listed above are without exception annual breeders. They are followed in rapid succession by *Culiseta inornata* and *Culex apicalis*. A week or so after these appear, the large number of summer species begin to make their appearance. These include *Anopheles*, several species of *Culex*, and usually *Aedes vexans* and *trivittatus*. The summer species continue to breed in suitable locations throughout the summer or intermittently with the summer rains.

A third group of species, which includes *Culex quinquefasciatus* and *Uranotaenia sapphirina*, may be present early in the season, but an appreciable population of this group usually does not appear until at least midsummer.

When the spring weather is uniformly cold well into May, and then is followed by a series of warm weeks, early and midseason species come out together, and there is little demarcation apparent between seasonal groups.

### DISTRIBUTION PATTERN

The mosquito fauna of Illinois resolves itself into three well-marked groups: (1) species of wide distribution, which are generally distributed in Illinois; (2) northern species that have a range widespread to the north, and that occur in only the northern portion of the state; and (3) southern species that have a range extending only slightly into Illinois and that are only sporadic north of the southern third of the state.

The species that are generally distributed include some of our most abundant nuisance species, such as *Aedes vexans*, *trivittatus*, *canadensis*, and *sticticus*, *Psorophora ciliata* and *ferox*, *Culex pipiens*, *apicalis*, and *restuans*, and *Culiseta inornata*.

Northern species whose range extends into northern Illinois include many of the annual-breeding large *Aedes* found in the glacial bogs and marshes in the extreme northeastern corner of the state. These species are *Aedes implacabilis*, *punctor*, *stimulans*, *excrucians*, *fitchii*, *flavescens*, and *cinereus*. A few of these, such as *flavescens* and *punctor*, are rarities; *excrucians* is present in only moderate numbers; the other species breed tremendous populations. Other mosquitoes in this northern group include *Culiseta morsitans*, confined to the tamarack bogs, and *Wyeomyia smithii*, the pitcher plant mosquito, which also occurs only in tamarack bogs. On the basis of Illinois collecting, *Anopheles walkeri* appears to be in the same group, since in this state it is abundant only in the cattail marshes and bogs of the northern part; records from other states indicate, however, that its range extends far to the south where marshes are available. Another northern mosquito taken in Illinois is *Aedes spencerii*, for which our only record came from the northwestern corner of the state.

Many southern species have been taken in the extreme southern tip of Illinois, most of them in the woodland pools of the post oak flats in the Mississippi River valley. The post oak flats list includes *Aedes fulvus*



*pallens*, *dupreii*, and *grossbecki*, *Psorophora howardii*, and *Anopheles crucians*. *Aedes thibaulti* has been taken near Carbondale, only 50 miles north of Cairo at the southern tip of Illinois. *Psorophora discolor*, *varipes*, and *cyaneescens*, and *Megarhinus septentrionalis* are southern species which often occur in the southern eighth or fourth of Illinois and sometimes sparingly north of that.

*Aedes aegypti* is another southern mosquito that has been taken in the St. Louis area and southward. Apparently it is unable to maintain itself there and occurs only as a temporary adventive during favorable years.

The southern house mosquito, *Culex quinquefasciatus*, which has been taken in some numbers in southern Illinois, occasionally extends northward at least as far as Urbana. Present collection data are far from conclusive but suggest that unfavorable winters push back the range of this species and that it migrates northward again during a succession of favorable years.

Perhaps our most unusual record is that for *Aedes aurifer*, a northern and eastern mosquito for which we have only one Illinois record, from the extreme southern tip of the state. Almost as unusual is the occurrence of the northern *Aedes cinereus* in the same locality. Presence of these northern species in southern Illinois illustrates a tendency, which has been noticed in several other insect groups, for occasional northern species to occur in or near the Mississippi River region south of the main body of their range.

## ECONOMIC IMPORTANCE

Mosquitoes cause an economic loss both as nuisances and as disease carriers.

The nuisance category includes all those species that inflict painful bites but that are not known to carry diseases. Most important in this group are the various species of *Aedes* and *Psorophora*; in cities and towns, species of *Culex* are of prime importance. Mosquitoes in the nuisance group inflict financial loss in various ways. In some sections they restrict the vacation season, with subsequent loss of patronage to resort establishments. They attack domestic animals and fowls and, when in large numbers, cause loss of weight and health. It has been estimated that 500 mosquitoes will draw one-twentieth of a pint of blood per day from an exposed animal. Sometimes mosquitoes

become so abundant as to interfere with or stop work by man, with a consequent loss of labor and accomplishment. Mosquitoes are among the worst nuisances of the out-of-doors and prevent enjoyment of recreational facilities by many people seeking exercise and relaxation.

Disease-transmitting mosquitoes are the sole vectors of malaria in human beings. Malaria is an endemic disease in southern Illinois. Only 50 miles to the south of Illinois, in the Mississippi River valley, occurs one of the high density areas of this disease in eastern North America. *Anopheles quadrimaculatus* is considered the only important mosquito species capable of transmitting the disease in Illinois.

Several other human diseases, such as yellow fever, filariasis, and dengue, are transmitted by certain species of mosquitoes that occur in Illinois. However, recent outbreaks of these diseases are so far removed geographically from Illinois, or the known mosquito vectors are so rare in this state, that the diseases are not considered a serious threat to Illinois citizens at the present time.

Public health workers have pointed out that a number of the service men returning from areas in the Pacific and Oriental regions where many insect-borne diseases occur will have been infected with these diseases. It is entirely possible that, upon returning home, the men may be a source from which mosquitoes may become infected with some of the tropical diseases and transmit them to other persons resident in the same locality. There is little possibility of knowing when and where such situations will arise. At the present time this problem seems to resolve itself into one of early detection and accurate diagnosis of the diseases by local medical authorities.

Up to the present time measures instituted against mosquitoes in Illinois have been directed toward abatement of nuisance species or toward control of the malaria vector, *Anopheles quadrimaculatus*.

## CONTROL CONSIDERATIONS

Control measures require consideration as individual problems in each community or locality. In different localities different species of mosquitoes are encountered, bringing into the control problem the treatment of different habitats, and involving differences in number and seasonal timing of

mosquito generations. Vagaries of precipitation or flooding frequently require rapid and unexpected changes in control plans.

Control measures, to be both economical and thorough, must be based on data obtained by a collecting and identification program. It is wasteful to attempt control measures of every water surface within an area, because many bodies of water (and frequently the most extensive ones) do not serve as breeding places for mosquitoes. Before actual control measures are planned, therefore, larval collections should be made that will serve as a guide to the areas to be treated.

To check the efficiency of control operations, it is necessary to supplement larval collections with biting records and adult collections throughout the season. These should include light trap collections and collections from resting stations.

The persistence of adult mosquitoes in a control area (shown by collections and biting records) may indicate that breeding places within the area have been overlooked or that mosquitoes are coming in from surrounding territory. After overlooked sites have been eliminated, collection and identification of larvae from breeding places in surrounding territory will indicate additional places which should also be treated.

When adult mosquitoes are identified as to species, facts about them, fundamental in controlling them, can readily be ascertained: (a) the types of situations in which larvae should be sought and (b) breeding habits, that is, whether the mosquitoes are annual, intermittent, or persistent breeders. Such information is useful in searching out places where control treatments must be applied and determining whether the treatments need to be applied only once a year for annual breeders, following rains or floods for intermittent breeders, or at regular intervals for persistent breeders.

### COLLECTING AND PRESERVING

Mosquitoes, both adults and larvae, are so delicate that their hairs and scales, upon which identification is based, are readily broken or rubbed off by careless handling. For this reason it is necessary to use great care in the procurement of material and in its subsequent handling and preparation for study.

### Larvae

A white enameled dipper, about 6 inches in diameter, is the most convenient utensil for collecting mosquito larvae. It may be used to dip up larvae from ponds and open water. The larvae can be removed from the dipper by one of two methods: (1) by pulling them into a wide-mouth medicine dropper and then discharging them into a vial of preservative or into a rearing capsule or (2) by pouring the contents of the dipper slowly onto a cloth strainer, picking the larvae off the cloth with forceps, and transferring them to a preservative or to a rearing vial. Hairs of the larvae are easily knocked off or the larvae mutilated in other ways if the transfer is made carelessly.

Alcohol makes a satisfactory preservative; 80 per cent alcohol is strong enough if the larvae are transferred to it with forceps. If a medicine dropper is used to transfer the larvae, a few drops of water will be discharged into the preservative with each larva, and a stronger solution of alcohol should be used. Not more than two live larvae should be placed at the same time in a single vial. If many thrash around in the vial, they knock the hairs off each other. As many as 10 larvae may be put in a three-dram vial, but they should be put in one at a time; the second and succeeding larvae should not be put in until the first and others have died. The most satisfactory way to kill a larva desired for a specimen is to place it in a separate killing vial and transfer it to a stock vial after it has died.

If larvae are handled in a vial only partially filled with preservative, they will jounce around, with a consequent loss of hairs and tufts. If the specimens are in a vial that is filled with preservative, without a single air bubble in it, they will move only slowly, no matter how violently the vial is agitated, and suffer no damage.

To preserve larvae in this way, the following procedure is recommended. Put the dead larvae in a small shell vial; put this vial, open end up, in a larger vial containing alcohol above the top of the shell vial. Now pick up a plug of cotton with a pair of forceps, soak the cotton with alcohol, and plug the open end of the shell vial with the cotton under the alcohol. Then take the shell vial out of the larger vial, put it in again plugged end down, and stopper the large vial, fig. 10A.

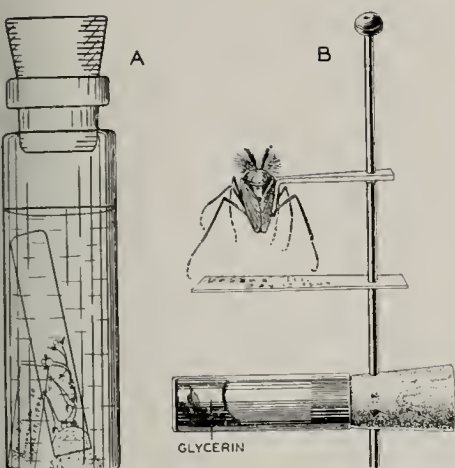


Fig. 10.—A, vial with inner vial containing mosquito larvae. B, mosquito mounted on crimped point and genitalia in microvial with plug through cork.

The plug is prepared by rolling a small piece of cotton between the fingers until it is fairly hard; after a little practice, a plug can be gauged that will fit the shell vial tightly but that is not so large that the vial will be broken when the plug is forced in. For storage, the larger vial should be kept well filled with alcohol; no evaporation will occur from the inner vial until the alcohol in the outer one is almost gone.

### Adults

There are three principal methods of collecting adult specimens: (1) by placing a killing tube over them as they sit in natural resting places or as they alight to bite, (2) by sweeping them from vegetation around their breeding places or sweeping them in the air as they swarm in mating flights, and (3) by attracting them to light traps.

**Killing Tube.**—Collecting adults with a killing tube calls for the same careful individual attention as does collecting larvae. Scales of the adults rub off very easily. For this reason, a tube with a strong killing agent should be used and only one live mosquito should be placed in a tube at one time, never more than 6 to 10 dead ones. It is wise to carry several boxes with loose, crumpled cellulocotton in the bottom and to transfer to these each dead mosquito from a killing tube. These boxes, which should have tight-fitting lids to prevent accumulation of dust on the specimens, should be so placed some-

where in the vehicle used for transport that they will not tip.

**Sweeping.**—Sweeping around vegetation does not net good study specimens of females, but it is valuable in collecting males. Frequently the males are present around a pond after all the immature stages in it have matured. Collections of males often give an accurate clue as to the species that develop in the pond, and their proportionate populations. The type of sampling done by sweeping vegetation is especially valuable in scouting temporary pools. A standard sweep net can be used, and the males picked out of the net with an aspirator. If the collector desires to obtain, by using a net, female mosquitoes that are in good condition, it is advisable that the net bag be made of very fine, light material. For routine collections of males, it is more practical to use a heavy bag that will withstand the abuse involved in hitting shrubs, thick herbage, and the like.

**Light Traps.**—A standard light trap used



Fig. 11.—Light trap. (Photograph by courtesy of Bureau of Entomology and Plant Quarantine, U.S.D.A.)



for mosquitoes at the present time is the New Jersey light trap, fig. 11. This attracts mosquitoes by means of a low wattage electric light bulb and is provided with a fan that blows them into a killing jar. The light bulb and fan are fastened to the inside of a large cover, which sheds rain, and a funnel is below the fan, fastened to three legs that support the trap when it is placed on the ground. The standard trap has a handle on the top, so that in the field it may be hung in a tree or from some other support. Mosquito specimens collected in this type of trap are usually in fairly good condition. Occasionally a swarm of beetles will be attracted to the light and blown into the killing jar. The beetles will crawl and thrash through the collection and mangle the mosquitoes.

Individual catches from each trap should be placed, while still pliable, between layers of cellulocotton in pill boxes. These layers should be thick enough to dry the insects thoroughly; otherwise mold may engulf the collection and render it useless for study. At the top of the pill box enough extra cotton should be added so that, when the lid is put on, the contents will be held firmly, but not so tightly as to crush the specimens. The container may then be transported without injury to the contents. A collection of pill boxes having different diameters and cardboard boxes 2 by 3 inches to 3 by 5 inches gives a good selection for handling catches of various sizes. These containers should be packed with cotton in a larger box if shipped by mail.

### Labeling

No matter what type of collection is made, each container, whether box, tube, or vial, should be labeled with station number, locality, date of collection, and name of collector. If the collection is of adults, note should be made of whether each container represents a biting record, a catch in a resting station, a light trap catch, or a sweep-net record.

## STUDY TECHNIQUES

When the mosquito material, either larval or adult, is brought to the laboratory for study, the same care must be exercised in its further preparation as was expended in its collection.

### Larvae

In most instances it is satisfactory to preserve larval material in alcohol. Diagnostic characters in most groups are seen readily on specimens in fluid.

For detailed studies of pecten and comb scales, a permanent mount is desirable. The larva should be dehydrated by being run through the alcohols to 95 per cent, cleared in benzol or cedar oil, and then mounted in Damar balsam. Each larva with an air tube should be cut through the seventh abdominal segment and the anterior portion mounted with the dorsum up and the posterior end with the left side up. This mounting will allow the study of the largest number of characters to best advantage. Pieces of broken slides should be placed around the specimen in such a way that they prevent the cover slip from flattening and distorting the specimen. When the air tube is flattened, its proportionate length to width becomes greatly distorted and cannot then be used as an accurate guide for identification.

### Adults

Material brought in from the field should be mounted for study. A very satisfactory method of mounting is to glue the insects on card points. If the end of the point is crimped down quite a distance, and moderately thin cellulose cement is used for glue, a neat mount can be made with the dorsum of the specimen uppermost. Before being pinned, adult specimens should be relaxed for a short time. There is a tendency for the specimen to become greasy if relaxed too long, and care must be observed regarding this point. Full data labels should be put on every specimen.

Critical study of adult material frequently requires detailed examination of the genitalia. A preparation of the genitalia may be made as follows: snip or break off the posterior half of the abdomen and place it in a vial of 5 per cent caustic potash or caustic soda solution; heat the vial in a boiling water bath for about 5 minutes; remove the preparation from the caustic solution and place it in distilled water; press it gently with a needle to squeeze out dislodged viscera and brush it carefully to clean off lodged scales or dirt. Transfer the preparation to fresh, distilled water, leave it

there for 15 minutes to an hour, and then transfer it to 80 per cent alcohol that is very weakly acidulated with acetic acid. After leaving it in this solution for a few minutes, transfer it to a drop of glycerin in a well mount on a slide. The preparation is then ready for microscopic examination. For preservation, place the preparation in a very small vial, about 4 by 10 mm., which has a droplet of glycerin about 3 mm. deep in the bottom. Cork the vial and then push the pin, on which the insect is mounted, through the cork sidewise, as in fig. 10B.

In the case of heavily sclerotized genitalia, especially those of many *Aedes*, it is necessary to use a caustic solution of 10 or 15 per cent instead of 5 per cent.

For making large numbers of genital preparations simultaneously, it is convenient to use a battery of small vials of cold caustic solution. Good results with the more heavily sclerotized genitalia, such as those of *Aedes* and *Psorophora*, can be obtained with about 12 hours of clearing in cold 5 per cent caustic solution. For the more weakly sclerotized preparations, such as those of *Culex*, 5 or 6 hours of clearing are usually ample.

It is often necessary to tease apart various structures of the genitalia in order to see certain characters. For this purpose fine needles can be made from 00 insect pins. Snip off the head of the pin; then, holding the pin near the blunt end with pliers, force it bit by bit into a wooden handle whittled to suit the user. Large match sticks make fairly good handles for small needles.

## REARING

Rearing is a necessary part of the mosquito study program. There are many instances in which the larvae, or the males or females, of two species cannot be differentiated, so that for final identification it is necessary to have associated larvae and adults. Two types of rearings are useful, individual rearings and group rearings.

### Individual Rearings

A single larva is isolated in a vial or dish, about half full of water, and food is added until the larva matures. When it molts to form a pupa, its cast larval skin is immediately preserved in alcohol or mounted on a slide. At ordinary room temperatures the

pupa will mature in 3 or 4 days, and the adult will emerge. It is advisable to have some sticks or crumpled paper towel in the top of the dry part of the container so that the adult may rest there and harden for 2 or 3 days before being killed. Adults killed immediately upon emergence will shrivel. Frequently the adult can be transferred into a second container without free water and kept there for a few days to avoid the possibility of its drowning and disintegrating in the water. The pupal skin, larval skin, and adult should be preserved and mounted according to usual methods, and specimens of the same rearing associated by means of a distinctive accession number system. A convenient system is to use a lot number for each collection and a letter for each individual of this collection. For example, specimens from collection No. 157, bear the accession designations 157C, 157D, 157E, etc.; the adult bearing the label 157C is associated with a larval skin and a pupal skin also bearing the accession designation 157C. No other specimen or skin in the collection has on its label 157C. With this method, it is possible to avoid getting the skins and adults of different rearings mixed. Every skin and adult should be labeled *promptly and clearly*.

### Group Rearings

In order to secure large numbers of study specimens in good condition, group rearings are of much use. Larvae may be placed in a large tube or mason jar and fed until they transform to pupae. For small cultures of less than 20 specimens, a cap vial about 1½ inches in diameter and 2 or 3 inches long is very satisfactory. After a culture has pupated, the container should be placed in a large dry-battery jar or cage having a tight muslin top, and a liberal amount of crumpled paper toweling placed in the bottom. The small container can be fastened upright on the inside of the large container by adhesive tape. After adults begin to emerge, water can be squirted through the muslin top onto the paper toweling, care being taken not to bathe the adults. This water will prevent desiccation of the adults and their premature death. In 2 or 3 days the adults will harden satisfactorily, and the entire cage can be treated with a fumigant to kill them. They may then be picked out of the cage and mounted.

### Larval Food

If larvae are collected when almost ready to pupate, a supply of the water in which they have been breeding and some of the organic matter from the bottom of the same pond will provide ample food to carry them to full development. If, however, they are collected at an earlier stage, it is necessary to add food. The safest type of food is fresh material from the bottom of a pond; this may be added to the rearing containers every 2 or 3 days. If this food cannot be obtained conveniently, various prepared foods, such as crumbled yeast, powdered dog biscuit, moldy corn, and gold fish food can be substituted. Because there is great danger that these concentrated foods will putrefy in the water, resulting in bacterial growth that will kill the mosquito larvae, they should be used in minute quantities.

### Temperature, Aeration, and Sunlight

If the rearing is done indoors in hot weather, death of the larvae may result from too high a temperature or from insufficient aeration. Larvae that normally live in a cold water environment should be kept relatively cold. It is desirable to keep jars containing such larvae in a running water bath. This will generally keep the temperature of the rearing medium below 75 degrees F. Good ventilation is necessary for indoor rearing of *Anopheles* larvae. Satisfactory results are obtained with these larvae by using rearing containers nearly filled with water and placed near or in an open window; for adult emergence the pupae should be transferred to containers with 2 or 3 inches of air space above the water. Some exposure to sunlight gives good results, but in the heat of summer this exposure must be short to avoid overheating the water.

### CLASSIFICATION

Mosquitoes belong to the order Diptera, or two-winged flies and to the family Culicidae. This family is characterized by the following adult structures: antennae, figs. 32-38, filamentous and slender, with 15 segments, the first 2 forming the base and the last 13 forming the slender thread. Each segment has a whorl of hairs, which in the males are extremely long. The eyes are large and conspicuous. The mouthparts

consist chiefly of a proboscis (which may be either short and flabby, or elongate and forming a beak) and a pair of maxillary palpi; the palpi are referred to in this report as "palps." The legs are long and spindly. The wings are fairly large; radial sector is 3-branched and Media is 2-branched; the branches of radial sector are either nearly straight or only slightly curved. The family is divided into two subfamilies, the Chaoborinae, or non-biting mosquitoes, and the Culicinae, the true mosquitoes. An adult of the Chaoborinae is readily distinguished from all adult Culicinae because it does not have a beak; each adult of the Culicinae has a well-developed beak or proboscis. The larvae of some Chaoborinae, however, might be readily confused with the larvae of true mosquitoes.

### Terminology

Many special terms are employed for distinctive parts of both adults and larvae of the mosquitoes, and these terms are used throughout the keys and descriptions. Fig. 12 is labeled to identify these distinctive parts of the larvae. Special parts of the

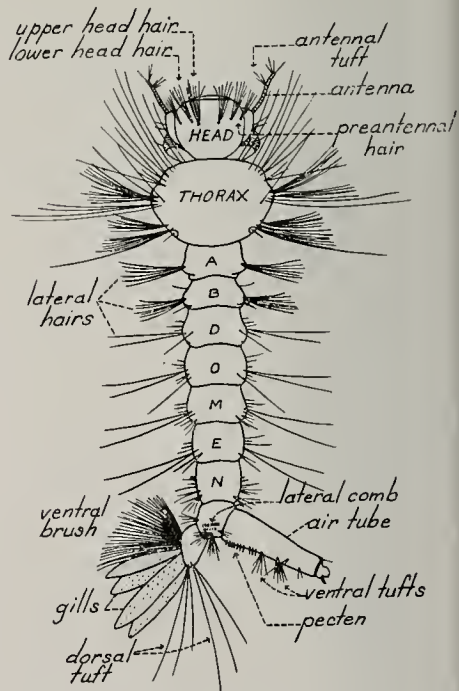


Fig. 12.—Larval diagram, Culicinae. (After King, Bradley, & McNeel.)



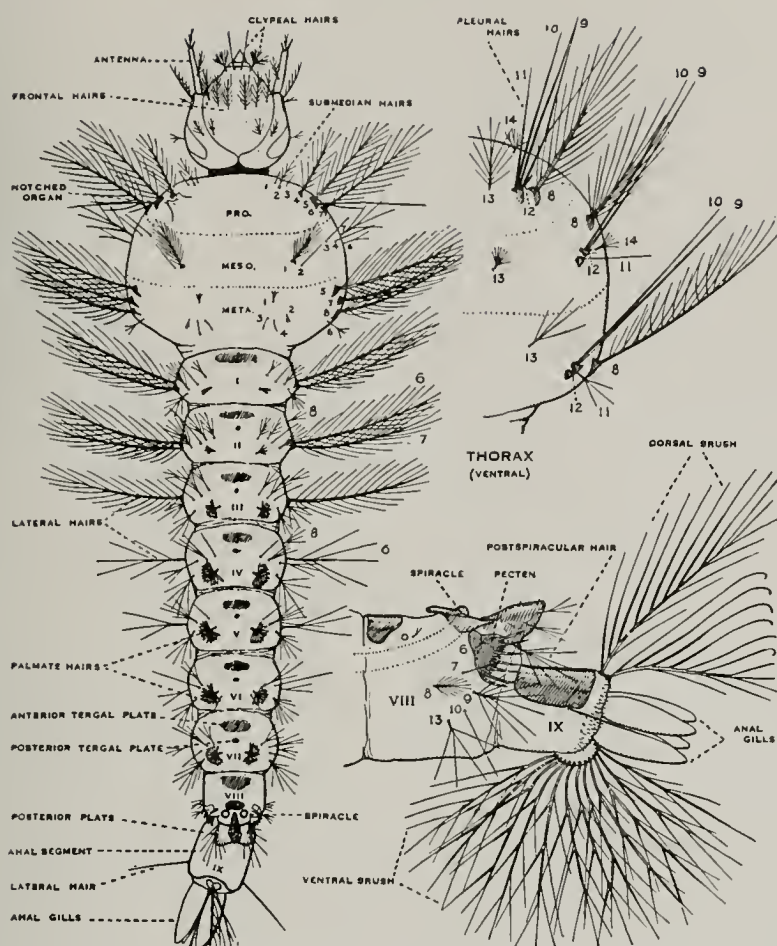


Fig. 13.—*Anopheles* larva. Left figure, dorsal view of entire larva; upper right figure, details of thorax; lower right figure, apex of abdomen, lateral aspect. (After Ross & Roberts, by courtesy of American Entomological Society.)

adults are identified on diagnostic drawings where they appear in the text associated with the keys. Distinctive structures of *Anopheles* larvae are shown in fig. 13.

### Literature

Additional information about mosquitoes, especially species not contained in this report, will be found in the general mosquito reports listed below. Additional information concerning these reports is given in the section "Literature Cited." Papers of more limited scope are mentioned later in the text in reference to particular genera or species.

1928. *The Mosquitoes of the Americas*, by Harrison G. Dyar.

1937. *The Mosquitoes of Minnesota*, by William B. Owen.
1939. *The Mosquitoes of the Southeastern States*, by W. V. King, G. H. Bradley, and T. E. McNeel.
1941. *The Mosquitoes of Arkansas*, by Stanley J. Carpenter.
1942. *The Mosquitoes of Oklahoma*, by L. E. Rozeboom.
1944. *The Mosquitoes of Wisconsin*, by W. E. Dickinson.
1944. *Handbook of the Mosquitoes of North America*, by Robert Mathe-son.
1944. *The Mosquitoes of Texas*, by Texas State Health Department.
1946. *The Mosquitoes of the Southern United States*, by Stanley J. Car-

penter, Woodrow W. Middlekauff, and Roy W. Chamberlain.

### Material Studied

The major part of the material on which this study is based was collected by staff members of the Insect Survey Section, Illinois Natural History Survey. Various other persons or organizations contributed much valuable material, and I am greatly indebted to them for permission to use their records in this paper. J. Lyell Clarke, Des Plaines Valley Mosquito Abatement District, Lyons, Illinois, and M. A. Dobbs and J. M. Gilbert, East St. Louis Health District, contributed extensive material. I wish to express my appreciation to officials of the Chicago Natural History Museum, who allowed me to study their mosquito collections; individual records from their material are marked in this paper with the initials CM. In addition, I am greatly indebted to officials of the U. S. Public Health Service and the Illinois State Department of Public Health for permission to use their extensive records of Illinois mosquitoes; these records are indicated in this paper by the abbreviation USPHS.

### Acknowledgments

I wish to express my gratitude to several workers who were kind enough to check keys and to give advice on many questions which have arisen during the progress of this report. Captains C. F. Gerlach and F. Earle Lyman of the U. S. Public Health Service were very helpful in these matters. I am especially indebted to Dr. Alan Stone, U. S. Bureau of Entomology and Plant Quarantine, who was of the utmost assistance regarding the taxonomic problems which arose time and again. I wish to thank also the officers of the U. S. National Museum for the loan of considerable study material of critical species, especially larval material of rare *Aedes* species.

Dr. C. O. Mohr, Dr. B. D. Burks, and Mr. G. T. Riegel were very active in the earlier years of this project, 1938-1942, in collecting and rearing material. In 1944 and 1945, Dr. Kathryn M. Sommerman and Dr. Milton W. Sanderson aided in this work. Dr. Sommerman and Mr. Riegel did the larger part of the rearing in the laboratory. I am greatly indebted to Dr. Som-

merman for the many original drawings which she made for this report.

Various individuals and organizations were extremely kind in either loaning drawings and cuts for use in this bulletin or in giving permission to reproduce illustrations appearing in their publications. On this score I am especially indebted to Professor Robert Matheson and the Comstock Publishing Company; the American Entomological Society; the Entomological Society of Washington; the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture; and the Malaria Control in War Areas, U. S. Public Health Service.

### KEY TO SUBFAMILIES

#### LARVAE

1. Antennae arising close together on a mesal raised area or protuberance of the head, fig. 14. . . . . Chaoborinae
- Antennae arising at sides of head, figs. 12, 13 . . . . . 2
2. Anal segment with a sclerotized ring or plate, figs. 17-20; antennae without long, prehensile hairs. . . . . Culicinae
- Anal segment without either a sclerotized ring or plate; antennae with long, prehensile hairs (*Mochlonyx* and *Eucorethra*), figs. 15, 16 . . . . . Chaoborinae

#### ADULTS

1. Proboscis elongate, figs. 32-38, many times longer than depth of head. . . . Culicinae
- Mouthparts forming only short submenbranous lobes which are no longer than depth of head. . . . . Chaoborinae

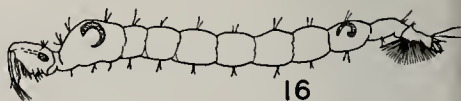


Fig. 14.—Head of larva of *Corethrella*.

Fig. 15.—Larva of *Mochlonyx cinctipes*. (Redrawn from Matheson.)

Fig. 16.—Larva of *Chaoborus punctipennis*. (Redrawn from Matheson.)

## Subfamily CHAOBORINAE

The adults of this subfamily are midge-like; their bodies usually are hairy but without scales. Four genera comprise the North American fauna of the subfamily. Of these, *Chaoborus*, *Corethrella*, and *Mochlonyx* occur in Illinois; the fourth genus, *Eucorethra*, is widely distributed north of Illinois but has not yet been taken in the state. Larvae of *Chaoborus*, fig. 16, have no air tubes. Larvae of the other three genera have either air tubes (*Mochlonyx* and *Corethrella*) or spiracular plates of the *Anopheles* type (*Eucorethra*); in these genera the larvae are predaceous and in general appearance resemble those of some biting mosquitoes.

A synopsis of the North American species, together with keys and illustrations, is presented by Matheson (1944).

## Subfamily CULICINAE

To date, 10 genera of this subfamily, representing the true mosquitoes, have been taken in Illinois. It should be emphasized that this mosquito group includes all the Culicidae with well-developed beaks, many species that bite, and in addition a few species that do not bite.

The subfamily Culicinae is frequently divided into two tribes, the Anophelini, including in the Illinois fauna only *Anopheles*, and the Culicini, including the other nine Illinois genera. However, the subfamily is sometimes divided into a large number of tribes. Since the final solution of this problem in taxonomy will require a study of the world fauna, the most practical solution for the present report has been to avoid segregation into tribes and to treat the subfamily as a single unit.

## Mosquitoes of Illinois

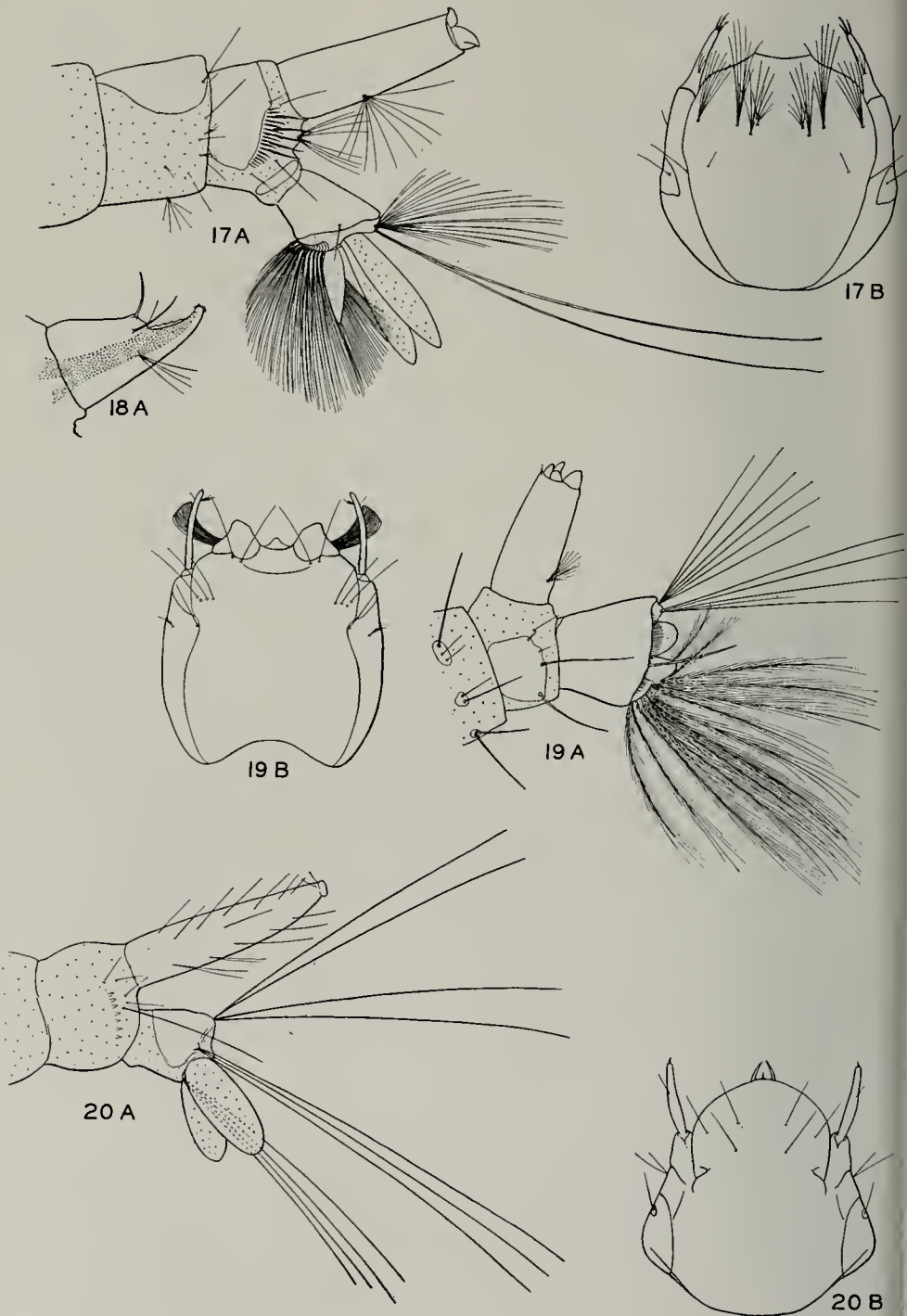
*Aedes aegypti* (Linnaeus)  
*Aedes aurifer* (Coquillett)  
*Aedes canadensis* (Theobald)  
*Aedes cinereus* Meigen  
*Aedes dorsalis* (Meigen)  
*Aedes dupreei* (Coquillett)  
*Aedes excrucians* (Walker)  
*Aedes fitchii* (Felt & Young)  
*Aedes flavescens* (Müller)  
*Aedes fulvus pallens* E. S. Ross  
*Aedes grossbecki* Dyar & Knab

*Aedes implacabilis* (Walker)  
*Aedes mitchellae* (Dyar)  
*Aedes nigromaculis* (Ludlow)  
*Aedes punctor* (Kirby)  
*Aedes sollicitans* (Walker)  
*Aedes spencerii* (Theobald)  
*Aedes sticticus* (Meigen)  
*Aedes stimulans* (Walker)  
*Aedes thibaulti* Dyar & Knab  
*Aedes triseriatus* (Say)  
*Aedes trivittatus* (Coquillett)  
*Aedes vexans* (Meigen)  
*Anopheles barberi* Coquillett  
*Anopheles crucians* Wiedemann  
*Anopheles punctipennis* (Say)  
*Anopheles quadrimaculatus* Say  
*Anopheles walkeri* Theobald  
*Culex apicalis* Adams  
*Culex erraticus* (Dyar & Knab)  
*Culex peccator* Dyar & Knab  
*Culex pipiens* Linnaeus  
*Culex quinquefasciatus* Say  
*Culex restuans* Theobald  
*Culex salinarius* Coquillett  
*Culex tarsalis* Coquillett  
*Culiseta inornata* (Williston)  
*Culiseta morsitans* (Theobald)  
*Mansonia perturbans* (Walker)  
*Megarhinus septentrionalis* Dyar & Knab  
*Orthopodomyia alba* Baker  
*Orthopodomyia signifera* (Coquillett)  
*Psorophora ciliata* (Fabricius)  
*Psorophora confinnis* (Arribáizaga)  
*Psorophora cyanescens* (Coquillett)  
*Psorophora discolor* (Coquillett)  
*Psorophora ferox* (Humboldt)  
*Psorophora horrida* (Dyar & Knab)  
*Psorophora howardii* Coquillett  
*Psorophora varipes* (Coquillett)  
*Uranotaenia sapphirina* (Osten Sacken)  
*Wyeomyia smithii* (Coquillett)

## KEY TO GENERA

## LARVAE

1. Eighth segment with a flat spiracular plate, but no air tube, fig. 13. . . . .1. *Anopheles*
- Eighth segment with an air tube, figs. 17-20 . . . . .2
2. Air tube short, with some of its sclerites at the apex forming long stout spurlike processes, fig. 18 . . . . .5. *Mansonia*
- Air tube without stout processes, its apical sclerites flat or conical, figs. 17, 19, 20 . . . . .3
3. Ventral brush of anal segment represented by only an apical pair of double hairs, fig. 20 . . . . .4. *Wyeomyia*



Larval parts: A, apex of abdomen; B, dorsum of head.

Fig. 17.—*Orthopodomyia signifera*.

Fig. 18.—*Mansonia perturbans* (the air tube only.) (After King, Bradley, & McNeel.)

Fig. 19.—*Megarhinus septentrionalis*.

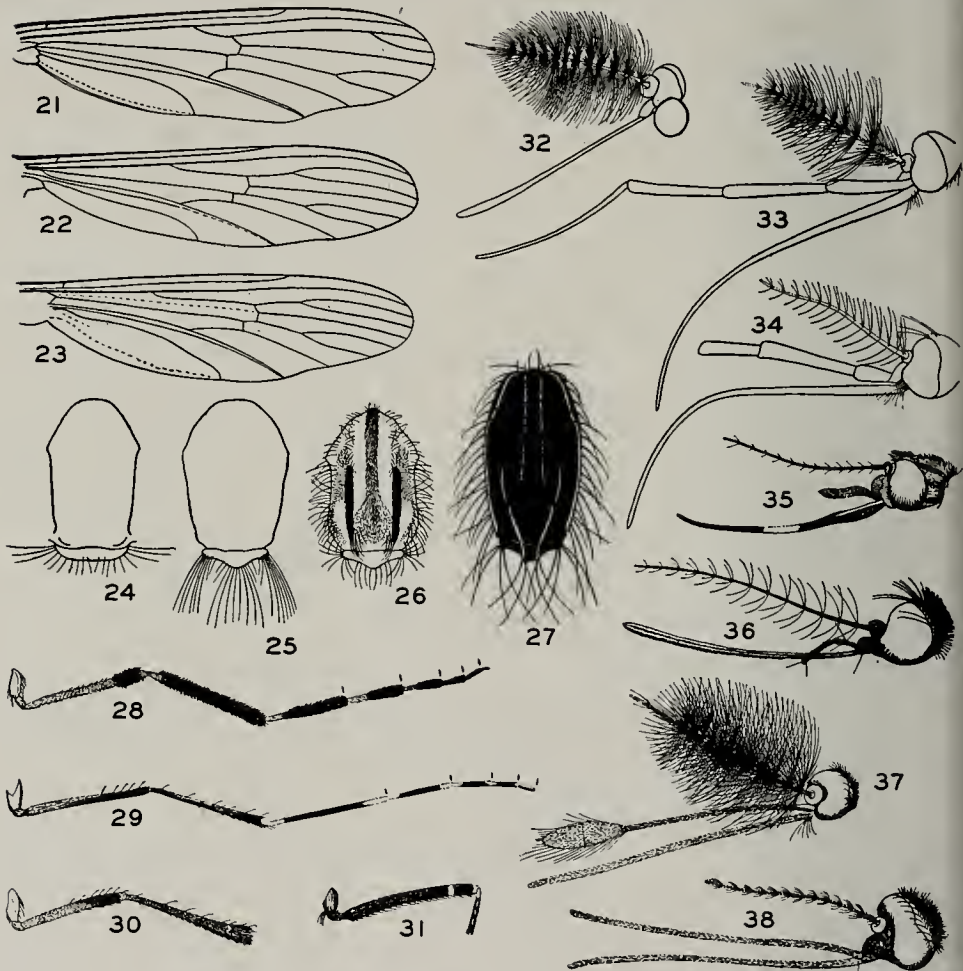
Fig. 20.—*Wyeomyia smithii*. Note ventral brush reduced to only four long hairs.



- Ventral brush of anal segment consisting of several tufts, figs. 17, 19. . . . .4
4. Anal segment with sclerotized plate not meeting ventrad, figs. 102-105. Many species of. . . . .9. *Aedes*
- Anal segment completely ringed by sclerotized plate, fig. 17. . . . .5
5. Air tube cylindrical and without pecten, figs. 17, 19. . . . .6
- Air tube either fusiform, fig. 175, or with a pecten, figs. 75, 98, 172. . . . .7
6. Abdominal segments 3-7 with three spine-bearing sclerotized plates on each side, fig. 19A; head quadrate, with stout mouth brushes and only a few single dorsal setae, fig. 19B. . . . .2. *Megarhinus*
- Abdominal segments 3-7 without lateral plates, sometimes segments 6 and 7 with dorsal saddle, fig. 17A; head oval, with fine bushy mouth brushes and with most of the dorsal setae multiple, fig. 17B. . . . .6. *Orthopodomyia*
7. Comb teeth situated on the posterior margin of a large sclerotized plate that covers most of the eighth segment; head with four stout black spines; fig. 72. . . . .3. *Uranotaenia*
- Comb teeth either on a small, poorly defined plate, fig. 172, or not on a plate; head with slender hairs, no stout spines, fig. 74. . . . .8
8. Air tube with a single pair of ventral tufts situated at base, figs. 74, 75. . . . .7. *Culiseta*
- Air tube either without ventral tufts, or with tuft near middle or apex, figs. 98-101, or with air tube having several pairs of tufts, figs. 80-85. . . . .9
9. Air tube with several pairs of ventral tufts of which some may be represented by single long hairs, figs. 79-85. . . . .8. *Culex*
- Air tube with only a single pair of ventral tufts, or with none. . . . .10
10. Ventral brush of anal segment having several tufts that arise out of the sclerotized ring, figs. 172-174. . . . .10. *Psorophora*
- Ventral brush of anal segment with all tufts situated posterior to sclerotized ring, fig. 111. Some species of. . . . .9. *Aedes*
- ADULTS
1. Fork of  $R_{2+3}$  close to margin of wing, cell  $R_2$  only half length of its petiole,  $R_{2+3}$ , fig. 21. . . . .2
- Fork  $R_{2+3}$  much farther from margin of wing, so that cell  $R_2$  is as long as its petiole, fig. 22. . . . .3
2. Beak curved almost into a quarter circle, palps of both sexes very long, those of female massive, figs. 33, 34; large species, wing length 6.5 mm. . . . .2. *Megarhinus*
- Beak only slightly curved, palps of both sexes short and abortive, fig. 32; small species, wing length under 3.5 mm. . . . .3. *Uranotaenia*
3. Mesoscutellum with apical margin evenly rounded, the setae arranged evenly along it, fig. 24; male with clavate palps, fig. 37, and female with palps as long as beak, fig. 38. . . . .1. *Anopheles*
- Mesoscutellum with apical margin incised to form a mesal lobe and two lateral lobes, with the setae grouped on these three lobes, fig. 25; male palps not clavate and female palps short, fig. 35. . . . .4
4. Mesonotum with a mesal line of short setae and scales, and with a wide, polished bare area along each side of the mesal line, fig. 26; hind femur with a tuft of projecting scales at apex, fig. 28. Large species of. . . . .10. *Psorophora*
- Mesonotum without linear, polished bare areas; hind femur with only a few projecting hairs at apex, fig. 30. . . . .5
5. Hind tarsi with one or two segments entirely white, the remainder entirely blue or black. A few species of. . . . .10. *Psorophora*
- Hind tarsi either with some segments banded, fig. 29, or all segments nearly the same color. . . . .6
6. Hind tarsi with wide or conspicuous bands of white on most segments, fig. 29. . . . .7
- Hind tarsi with no bands or with only inconspicuous ones. . . . .13
7. Second, third, and fourth tarsal segments each with a narrow white band at each end, fig. 29. . . . .8
- Second, third, and fourth tarsal segments each with a white band at base only, figs. 127-131. . . . .10
8. Beak black, with a definite white band in middle, as in fig. 35. The species *tarsalis* in. . . . .8. *Culex*
- Beak not banded, either all black, or mottled, or black with rows of white scales along its entire length. . . . .9
9. Mesonotum either without white lines, or generally cream in color as in fig. 119. A few species of. . . . .9. *Aedes*
- Mesonotum nearly black, with a series of white lines as in fig. 27. . . . .6. *Orthopodomyia*
10. Post-spiracular area entirely bare; hairs on disc of mesonotum long, abundant, and erect, fig. 39. . . . .5. *Mansonia*
- Post-spiracular area with bristles or a patch of scales; hairs on disc of pronotum much more appressed, fig. 41. . . . .11
11. Outer faces of hind femora in general dark but each with a transverse band of white scales near apex, fig. 31. A few species of. . . . .10. *Psorophora*
- Outer faces of hind femora without such bands. . . . .12

12. Wings with either Costa banded with white-scaled areas and black-scaled areas, or anal vein white scaled for basal two-thirds with apical portion black scaled. A few species of . . . . .  
 . . . . . 10. *Psorophora*  
 Wings either almost uniformly white or

- dark scaled, or the two types of scales mingled in a salt-and-pepper, patternless mixture. Some species of . . . . . 9. *Aedes*  
 13. Mesonotum covered with a close mat of blue-black scales, with bristles only around periphery; fork of  $R_{2+3}$  basad of fork of  $M_{1+2}$ , fig. 22 . . . . . 4. *Wyeomyia*

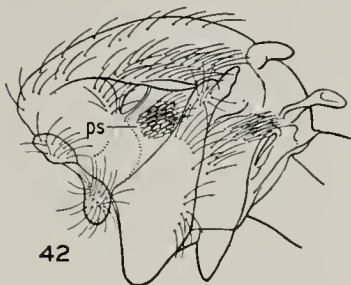
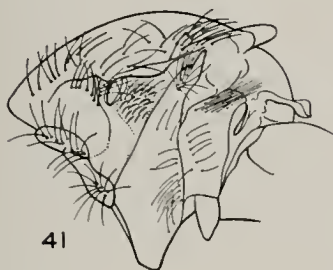
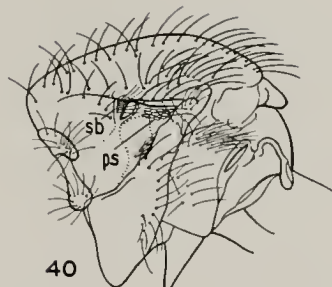
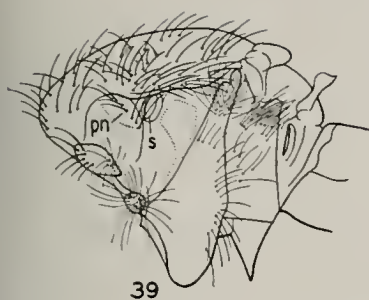


## Adult Parts

- Fig. 21.—*Uranotaenia sapphirina*, wing.  
 Fig. 22.—*Wyeomyia smithii*, wing.  
 Fig. 23.—*Aedes vexans*, wing.  
 Fig. 24.—*Anopheles quadrimaculatus*, mesonotum.  
 Fig. 25.—*Aedes vexans*, mesonotum.  
 Fig. 26.—*Psorophora ciliata*, mesonotum.  
 Fig. 27.—*Orthopodomyia signifera*, mesonotum.  
 Fig. 28.—*Psorophora ciliata*, hind leg.  
 Fig. 29.—*Aedes canadensis*, hind leg.  
 Fig. 30.—*Psorophora varipes*, portion of hind leg.

- Fig. 31.—*Psorophora confinnis*, hind femur.  
 Fig. 32.—*Uranotaenia sapphirina*, male head.  
 Fig. 33.—*Megarhinus septentrionalis*, male head.  
 Fig. 34.—*Megarhinus septentrionalis*, female head.  
 Fig. 35.—*Aedes sollicitans*, female head.  
 Fig. 36.—*Orthopodomyia signifera*, female head.  
 Fig. 37.—*Anopheles quadrimaculatus*, male head.  
 Fig. 38.—*Anopheles quadrimaculatus*, female head.





Adult Thorax, Lateral Aspect. Abbreviations: *pn*, pronotal bristles; *ps*, post-spiracular bristles or scales; *s*, spiracle; *sb*, spiracular bristles.

Fig. 39.—*Mansonia perturbans*.

Fig. 40.—*Culiseta inornata*.

Fig. 41.—*Psorophora confinnis*.

Fig. 42.—*Aedes stimulans*.

- Mesonotum with several series of erect bristles extending above scales on disc, fig. 42; fork of  $R_{2+3}$  at about same level as that of  $M_{1+2}$ , fig. 23. . . . . 14
14. Mesonotum either with broad lateral bands or areas of white or cream scales, figs. 115, 120–123, or almost entirely covered with cream scales. . . . . 15
- Mesonotum mostly dark scaled, at most with a scattering of light scales, or with narrow weak lines of them. . . . . 16
15. Hind tibiae enlarged and shaggy toward apex, with setae not longer than width of tibia at apex, fig. 30; spiracular bristles usually present, fig. 41. A few species of. . . . . 10. *Psorophora*
- Hind tibiae slender to apex, not shaggy, often with a scattering of setae longer than width of tibia at apex, figs. 29, 125, 126; spiracular bristles absent. Many species of. . . . . 9. *Aedes*
16. Post-spiracular area bare, and spiracular bristles lacking, as in fig. 39. . . . . 8. *Culex*
- Thorax either with post-spiracular area having bristles or scales, fig. 42, or spiracular bristles present, fig. 40, or both. . . . . 17
17. Spiracular bristles present; post-spiracular area sometimes with scales but never with hairs, fig. 40. . . . . 7. *Culiseta*

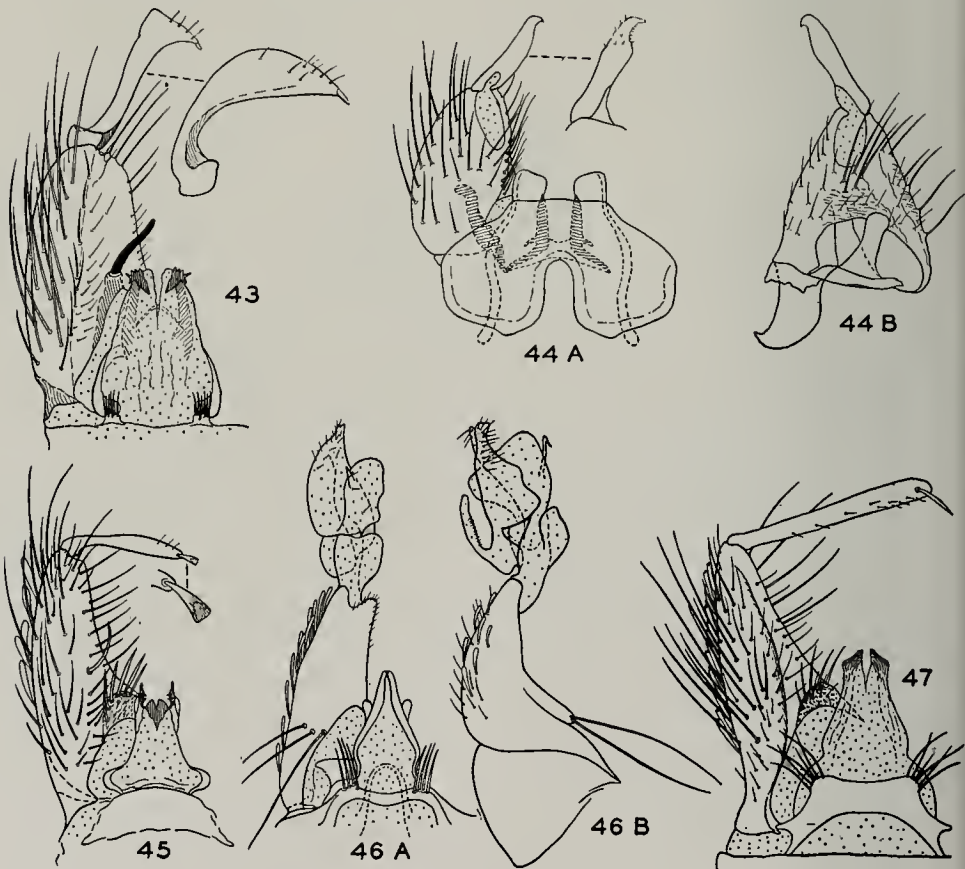
Without spiracular bristles; post-spiracular area with hairs or hairs and scales, fig. 42. Many species of. . . . 9. *Aedes*

#### MALE GENITALIA

1. Dististyle with a contorted mass of branches, fig. 46. . . . . 4. *Wyeomyia*  
Dististyle either unbranched, fig. 43, or with only one or two simple lobes, figs. 133, 178. . . . . 2
2. A pair of subcylindrical arms (claspettes) arising from dorsum of capsule, and tipped with a sclerotized filament, figs. 136–158. Most species of. . . 9. *Aedes*  
Claspettes absent, platelike, fig. 70, or each tipped with a cluster of spines, fig. 177. . . . . 3
3. Dististyle bilobed, its mesal margin bearing a long hook and a large membranous lobe, fig. 178. The species *howardii* in. . . . . 10. *Psorophora*  
Dististyle without an accessory membranous lobe. . . . . 4
4. Basistyle with an apico-mesal shoulder bearing a cluster of specialized, blade-like or spatulate spines, which are frequently complex in structure, figs. 88–95. . . . . 8. *Culex*  
Basistyle either without an apical shoulder, or the shoulder bearing only narrow spines. . . . . 5

5. Apex of basistyle continuing as a pointed lobe beyond insertion of dististyle, fig. 135. The species *cinereus* in.....9. *Aedes*  
Dististyle situated at apex of basistyle, fig. 43.....6
6. Dististyle with a pointed lobe projecting beyond apical spur, fig. 133. The species *vexans* in.....9. *Aedes*  
Dististyle with apical style terminal, fig. 45, or apex round, fig. 47, or truncate, fig. 180.....7
7. Claspettes each with a stalklike base, and with a comblike cluster of spurs or setae at apex, figs. 177, 179-182; dististyle sinuate, fig. 177, or bulbous, figs. 179-182. Most species of...10. *Psorophora*

- Claspettes absent or platelike, fig. 70, dististyle of various shapes.....3
8. Basistyle with a stout peglike rod on mesal face near middle; dististyle with apical half very wide, its apical seta forming a stout spurlike tip, fig. 43.....5. *Mansonia*  
Basistyle frequently with one or more stout setae on mesal face, but never with a rodlike structure; dististyle either not enlarged at apex or with a peglike or hairlike apical seta, figs. 45, 47.....9
  9. Basistyle short and ovate, with a pair of large, stout spines dominating the ventral aspect of the basal portion, fig. 70.....1. *Anopheles*  
Basistyle either long and slender, fig. 45,



## Male Genitalia

Fig. 43.—*Mansonia perturbans*, ventral aspect, and lateral aspect of dististyle.

Fig. 44.—*Uranotaenia sapphirina*; A, ventral aspect, with lateral aspect of dististyle; B, mesal aspect of clasper, with mesosome and other mesal structures removed.

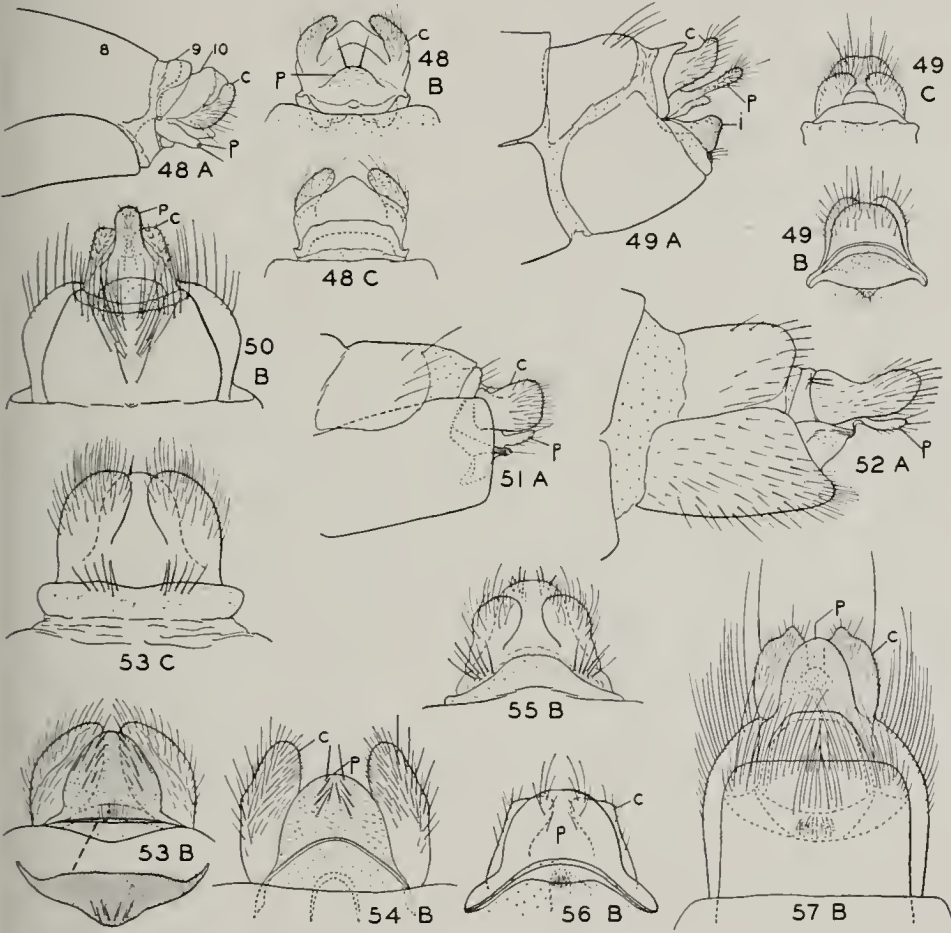
Fig. 45.—*Orthopodomyia signifera*, ventral aspect.

Fig. 46.—*Wycomyia smithii*; A, ventral aspect; B, lateral aspect.

Fig. 47.—*Megarhinus septentrionalis*, ventral aspect.

- or without a pair of isolated stout spines on basal portion of ventral aspect, fig. 44 .....10
11. Ninth tergite forming a large bilobed sclerotized plate whose lateral lobes are nearly as long as the basistyle, fig. 44. . . . .3. *Uranotaenia*
- Ninth tergite forming at most a plate as wide as in fig. 47. ....11
11. Apical seta of dististyle single, slender, and pointed at tip, figs. 47, 134. ....12
- Apical seta of dististyle short and either divided, fig. 78, or truncate at tip, fig. 45 .....13

12. Base of basistyle with a mesal, arcuate pad bearing a crown of stout spines; dististyle cylindrical, with apical spine just before apex, fig. 47. . . . .2. *Megarhinus*
- Base of basistyle without a mesal pad; dististyle tapering toward apex, apical spine issuing from tip, fig. 134. The species *aegypti* in. ....9. *Aedes*
13. Apical spine of dististyle double, each ray short and stout; mesosome without lateral teeth at apex, fig. 78. . . . .7. *Culiseta*
- Apical spine of dististyle cone shaped, wide and truncate at apex, and with what appears to be a minute fringe



Female Genitalia: A, lateral aspect; B, ventral aspect; C, dorsal aspect. Abbreviations: c, cercus; p, postgenital plate; i, insula plate.

- Fig. 48.—*Anopheles quadrimaculatus*.  
Fig. 49.—*Uranotaenia sapphirina*.  
Fig. 50.—*Wyeomyia smithii*.  
Fig. 51.—*Mansonia perturbans*.  
Fig. 52.—*Orthopodomyia signifera*.  
Fig. 53.—*Culiseta inornata*.  
Fig. 54.—*Culex restuans*.  
Fig. 55.—*Culex apicalis*.  
Fig. 56.—*Culex erraticus*.  
Fig. 57.—*Megarhinus septentrionalis*.

along the edge; mesosome with a few short, lateral teeth at apex, fig. 45....  
.....6. *Orthopodomyia*

#### FEMALE TERMINALIA

1. Cerci round and finger-like, wide apart and directed almost dorsad, fig. 48....  
.....1. *Anopheles*  
Cerci either closer together, or leaflike and directed posterad, figs. 49-57.....2

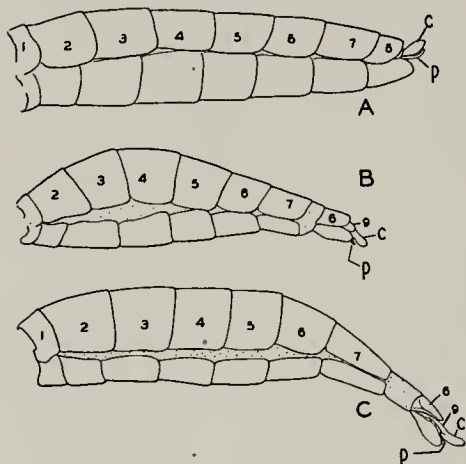


Fig. 58.—Abdomen of adult female, lateral aspect. A, *Culiseta inornata*; B, *Ardes aegypti*; C, *Psorophora ciliata*. Abbreviations: c, cercus; p, postgenital plate.

2. Eighth segment retractile, markedly narrower than seventh and joined to it by a wide band of membrane, figs. 58B, C; cerci either long and narrow, fig. 159, or extending far beyond postgenital plate, fig. 160.....3  
Eighth segment not retractile, practically the same diameter as the seventh, joined to it by a narrow strip of membrane, fig. 58A; cerci short and extending little if at all beyond end of postgenital plate, figs. 49-57.....4
3. Ninth tergite consisting of a fairly wide, indefinitely outlined rectangular sclerite, figs. 159-167.....9. *Aedes*  
Ninth tergite consisting of a heavily sclerotized, longitudinal rod enlarged at apex and extending basally beneath eighth tergite, fig. 184.....10. *Psorophora*
4. Postgenital plate extending considerably beyond cerci, fig. 50.....4. *Wyeomyia*  
Postgenital plate extending only slightly if at all beyond cerci, fig. 49.....5
5. Eighth tergite long and wide, forming a flat hood that extends considerably beyond sternite; ninth segment and cerci

- flattened and horizontal, fig. 57.....  
.....2. *Megarhinus*
- Eighth tergite hemicylindrical, shorter than sternite and not at all hoodlike, figs. 49, 52.....6
6. Cerci with base enlarged, middle constricted, and apex expanded, fig. 52....  
.....6. *Orthopodomyia*  
Cerci with base not at all enlarged, but sometimes expanded at apex, fig. 51.....7
7. Insula plate well developed as a sclerotized, arcuate, cushion-like crescent, fig. 49; ninth tergite with apical margin rounded and sclerotized, slightly overhanging base of cerci.....  
.....3. *Uranotaenia*  
Insula plate either entirely membranous or forming a band that bears a small mesal tuft of setae, fig. 53.....8
8. Cerci from edge to edge almost vertical in position, the apex markedly widened; eighth sternite nearly twice length of eighth tergite, fig. 51.....5. *Mansonia*  
Cerci from edge to edge inclining to horizontal in position, the apex narrowed at least slightly, fig. 53; eighth sternite longer than eighth tergite, but not as much longer as in *Mansonia*.....9
9. Postgenital plate parallel sided and truncate, with a long apical seta near each corner and many small setae on the central area, fig. 161; ninth segment narrow. A few species of.....9. *Aedes*  
Postgenital plate rounded or pointed, with a row or cluster of several scattered setae near apex, fig. 54; ninth segment wide.....10
10. Postgenital plate very wide, as in fig. 56.....8. *Culex*  
Postgenital plate much narrower, figs. 53-55.....11
11. A U-shaped internal sclerite present in membranous folds of spermatheca, fig. 54.....8. *Culex*  
No distinct internal sclerite evident in folds of spermatheca, fig. 55.....12
12. Ninth tergite forming a sclerotized, fairly straight bridge, with a pair of clusters of setae situated close together, fig. 53.....7. *Culiseta*  
Ninth tergite consisting of irregular folds at most semisclerotized, with clusters of setae situated far apart near lateral margins, fig. 55.....8. *Culex*

#### 1. *ANOPHELES* Meigen

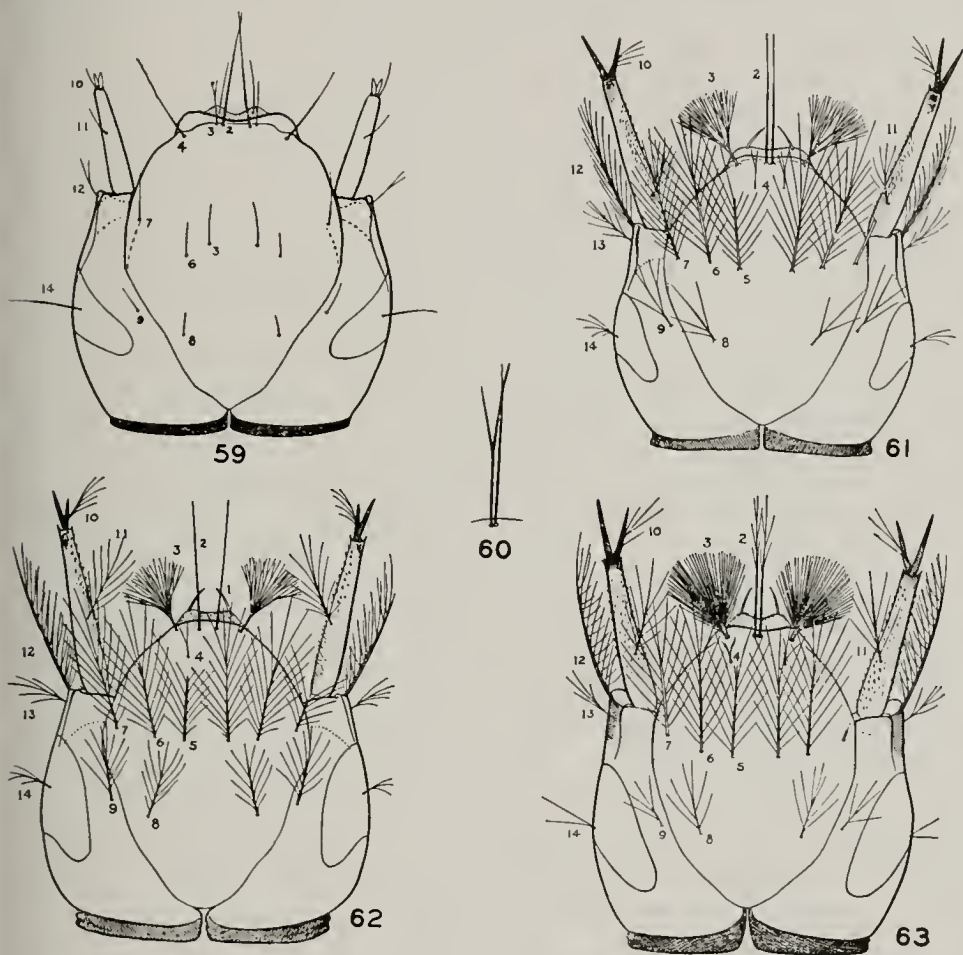
Of the Illinois mosquitoes, *Anopheles* is the most distinctive genus and the most important one. The larvae, fig. 13, are readily distinguished by the platelike aper-



ture of the breathing apparatus, which in all other Illinois mosquito larvae is tubular; the adults have the scutellum evenly rounded, not trilobed, and the males have the apical segments of the palps greatly enlarged, fig. 37. According to present information, *Anopheles quadrimaculatus* is the chief carrier of malaria in Illinois.

In proportion to their size, few mosquito genera present so many difficulties regarding larval identification as the North American *Anopheles*. There is undoubtedly much variation within many of the species, both

in the hair arrangement of the larvae and in the details of the male genitalia. Consequently, in Illinois the main basis for identification of the species in this genus should be the adult females. In other sections of the country the larvae may present the only reliable characters for certain complexes of the species. Many keys have been presented for the identification of males by means of the genitalia. The studies of Roth (1944), however, have substantiated my own observation that the characters of the male genitalia can be used only on an average basis



Heads of *Anopheles* Larvae

Fig. 59.—*A. barberi*. (After Ross & Roberts.)

Fig. 60.—*A. occidentalis* (inner clypeal hairs only).

Fig. 61.—*A. punctipennis*. (After Ross & Roberts.)

Fig. 62.—*A. quadrimaculatus*. (After Ross & Roberts.)

Fig. 63.—*A. walkeri*. (After Ross & Roberts.) Hair numerals used on this plate are those currently employed in the taxonomic literature on mosquitoes.

and cannot be used as a means of absolute diagnosis in all cases.

The recent work of Ross & Roberts (1943) and Roth (1944) illustrates extensively many diagnostic and other structural features of this genus. Additional descriptions and a summary of distribution is given by King & Bradley (1941), and biological material by Bradley & King (1941). An interesting study of variation in larval characters has been made by Roth (1945b).

To date, five species of this genus have been taken in Illinois. A sixth, *occidentalis*, has been taken in Iowa across the Mississippi River from Illinois. As it undoubtedly occurs in Illinois, it has been included in the key.

#### KEY TO SPECIES

##### LARVAE

1. Head hairs 5, 6, and 7 short and simple, fig. 59; lateral body hairs with only short feathering. . . . .1. *barberi*  
Head hairs 5, 6, and 7 long and plumose, fig. 61; lateral hairs of thorax and first

- three abdominal segments with long feathering, fig. 64. . . . .2
2. Fourth and fifth abdominal tergites with hairs 0 and 2 plumose, fig. 65. . . . .5. *crucians*  
Fourth and fifth abdominal tergites either with hairs 0 inconspicuous or with hairs 2 only single or double, fig. 64. . . . .3
3. Head hairs 3 very dense, fan shaped from base, so that no basal stalk is evident, fig. 63; head hairs 2 sometimes feathered at tip; prothoracic hairs 1 sometimes branched. . . . .3. *walkeri*  
Head hairs 3 less dense, the fan shaped portion beginning some distance from base so that a basal stalk is formed, fig. 61; head hairs 2 never feathered at tip; prothoracic hairs 1 rarely branched. . . . .4
4. Second abdominal segment with hairs 1 well developed, sclerotized and palmate, fig. 64. . . . .2. *quadrimaculatus*  
Second abdominal segment with hairs 1 small, at most fanlike, fig. 65, not at all like the palmate hairs on segment 3. . . . .5

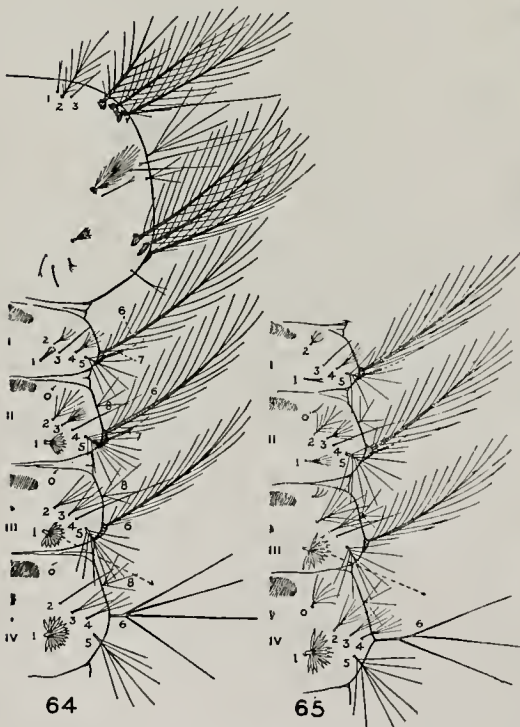
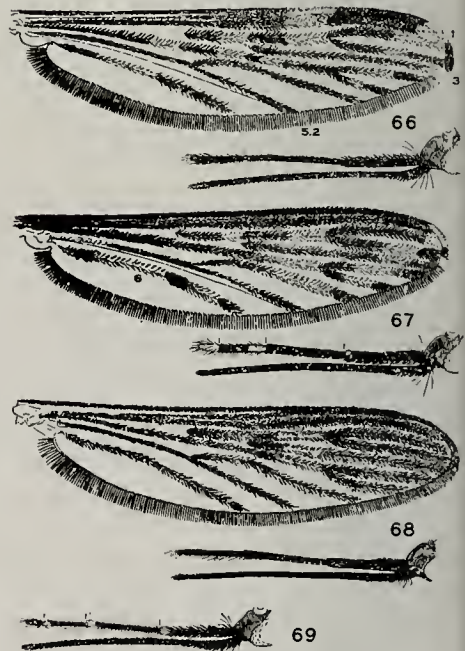


Fig. 64.—*Anopheles quadrimaculatus*, larva, portion of dorsum.

Fig. 65.—*Anopheles crucians*, larva, portion of dorsum.



#### Parts of *Anopheles* Adults

Fig. 66.—*A. puncticornis*, wing and mouthparts.

Fig. 67.—*A. crucians*, wing and mouthparts.

Fig. 68.—*A. quadrimaculatus*, wing and mouthparts.

Fig. 69.—*A. walkeri*, mouthparts. (Figs. 64–69 after Ross & Roberts.)

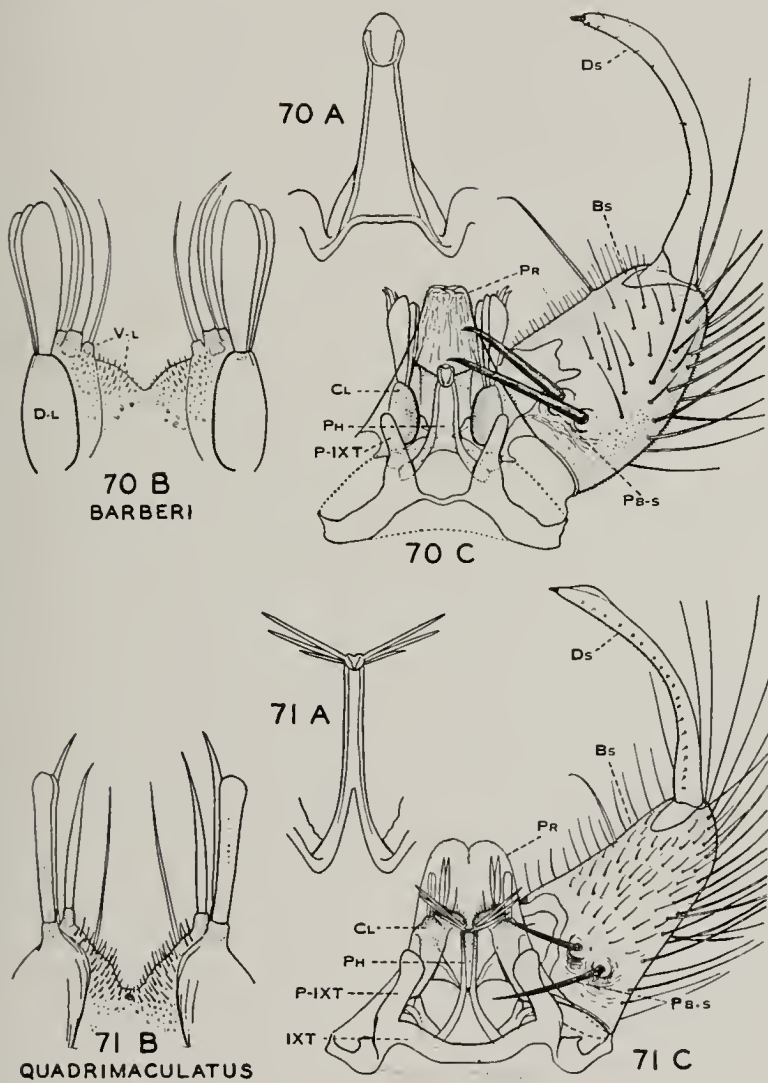


- 5. Head hairs 2 wide apart, fig. 62.....2. *quadrимaculatus*  
Head hairs 2 close together, fig. 61.....6
- 6. Head hairs 2 always simple, fig. 61.....4. *punctipennis*  
At least one of the two head hairs 2 usually with a conspicuous branch, fig. 60...  
.....occidentalis

ADULTS

- 1. Wings with spots or bars of white or yellowish-white scales along anterior margin and anal vein, figs. 66, 67.....2

- Wings without any pale patches, all scales dark, fig. 68, except sometimes apical fringe hairs.....3
- 2. Anal vein with 3 short dark bars separated by white bars; palps dark with white bands, fig. 67; Costa with a white spot only at apex of wing...5. *crucians*  
Anal vein with apical half and extreme base black, and with a single white area between; palps black, unbanded, fig. 66; Costa with an apical white spot and usually also a preapical spot or bar...4. *punctipennis*



Figs. 70-71.—Male genitalia of *Anopheles*. A, phallosome; B, claspette; C, ventral aspect of entire structure. Abbreviations: Bs, basistyle; CL, claspette; Ds, dististyle; IXT, ninth tergite; Pb-s, parabasal spine; Ph, phallosome; P-IXT, process of ninth tergite; Pr, proctiger. (After Ross & Roberts.)

3. Tip of wing with a patch of silvery or golden fringe scales; dark wing spots very pronounced.....*occidentalis*  
Tip of wing with fringe not different from remainder; dark wing spots frequently obscure .....4
4. Palps narrow and filiform, fig. 38 (females).....5  
Palps enlarged into an oval apical club, fig. 37 (males).....7
5. Palps black, with white rings, fig. 69....  
.....3. *walkeri*  
Palps entirely black, without rings, fig. 68  
.....6
6. Wings without a trace of spotting; wing length about 3.5 mm.....1. *barberi*  
Wings with definite darker areas giving a spotted appearance, fig. 68; wing length about 5.0 mm.....2. *quadrимaculatus*
7. Mesosome without leaflets at apex, fig. 70; wing length under 3.5 mm...1. *barberi*  
Mesosome with a cluster of leaflets at apex, fig. 71; wing length over 3.5 mm.  
.....8
8. Lobes of ninth tergite stout, apex wide, sometimes enlarged, fig. 71.....  
.....2. *quadrимaculatus*  
Lobes of ninth tergite narrower, usually tapered at apex.....3. *walkeri*

### 1. *Anopheles barberi* Coquillett

LARVA.—Fig. 59. Length 6 mm. Head with almost all hairs simple and unbranched, especially conspicuous being hairs 3, 5, 6, and 7. Thorax and abdomen with only short feathering on lateral major hairs. Segments 3-7 with a pair of palmate hairs, segment 2 with moderately developed palmate hairs. Pecten consisting of an irregular series of long teeth, each tooth with serrations at base.

FEMALE.—Wings with veins having almost uniformly dark scales, neither the field of the wing nor the fringe with dark spots or light patches.

MALE.—Similar in color and general structure to female. Genitalia, fig. 70, with two large parabasal spines; mesosome tapered, without apical leaflets; claspettes with three setae on the ventral lobe and three broad scales arising in a compact group from the dorsal lobe.

This species contains the smallest individuals of *Anopheles* in North America, mosquitoes that in general appearance are easily confused with small dark *Culex* individuals. The setation of the larvae and structures of the male genitalia separate this species indubitably from all other North American anophelines.

bitably from all other North American anophelines.

It has been found in only a few of the many tree holes investigated and is either much more critical in its choice of breeding place or much less abundant than several other tree hole species such as *Aedes triseriatus*. As pointed out by King, Bradley, & McNeel (1939), this species has been proved susceptible to malaria parasites but is of doubtful importance in malaria transmission. It is widely distributed in the southern and eastern states.

ILLINOIS RECORDS.—Six larvae, collected June 29 to July 6, and many males and females, collected May 25 to October 10, are from Alton (USPHS), Cahokia (USPHS), Camp Ellis (USPHS), Carterville (USPHS), Crab Orchard Lake (USPHS), Des Plaines, East Alton (USPHS), East St. Louis, George Field (USPHS), Hampshire (USPHS), Johnston City (USPHS), Marion (USPHS), Momence, Mount Vernon (USPHS), Onarga, Savanna (USPHS), Scott Field (USPHS), and Springfield (USPHS).

### 2. *Anopheles quadrимaculatus* Say

LARVA.—Fig. 62.—Length 8 mm. Head with hairs 2 long, simple and widely separated; hairs 3 plumose, branching some distance from base; hairs 5, 6, and 7 long and plumose. Thorax and first three segments of abdomen with long feathering on lateral major hairs. Abdominal segments 4 and 5 with hairs 2 usually single, rarely double; of the total of four "hair 2's" on segments 3 and 4, seldom is more than one double. Palmate hairs on segments 3 to 7, frequently also on segment 2. Pecten with a series of well-spaced long teeth, between each of which is a group of three or four short teeth. Body hairs shown in fig. 64.

FEMALE.—General color dark brown. Palps entirely dark brown to black, with no annulations. Wings, fig. 68, uniformly dark scaled, the scaling slightly darker at the fork of  $R_{2+3}$ ,  $M_{1+2}$ , the base of  $R_s$  and the base of  $R_{4+5}$ . These darker scalings make four dark spots, sometimes very pronounced, sometimes scarcely perceptible.

MALE.—Similar in color and general structure to female. Genitalia, fig. 71, with two large parabasal spines; mesosome slender, its apex with a group of three leaflets on each side; claspettes each with setae of dorsal lobe round at tip, those of ventral lobe sharp and pointed. The number of setae on each lobe varies considerably; if

only two or three are present on the dorsal lobe, they may fuse at the tip.

The diagnosis of this species is clear cut only in the female. The separation of the larvae of this species from those of *punctipennis* is frequently difficult. Nearly all the specimens I have seen from Illinois will key out without difficulty, but an occasional larva is encountered that falls squarely between the two alternatives of couplet 5. In our series of associated larval skins, there is considerable variation in the branching of hair 2 on abdominal segments 4 and 5; the more reliable character seems to be the distance apart of head hairs 1. The males are extremely close to those of *walkeri*, although in all of our specimens the separation on the lobes of the ninth tergite is fairly satisfactory. The halteres of *quadrimaculatus* are usually much darker than those of *walkeri*, but these characters vary somewhat, and, in preserved specimens, the difference tends to disappear with time.

In Illinois, the breeding season of *quadrimaculatus* begins nearly a month after that of *punctipennis* in the south and of *walkeri* in the north, indicating a restriction imposed by water temperature. The preference for warmer water is further suggested by the abundance of *quadrimaculatus* in more open and still bodies of water during the heat of the summer when *punctipennis* is found only in more heavily shaded or markedly cooler waters. The habitat preference of *quadrimaculatus*, which is quite wide, includes small pools, backwaters, and shallow basins of large lakes and marshes. Abundant populations of larvae are almost always associated with emergent vegetation, ranging from plants such as *Jussiaea diffusa*, which never extends more than a few inches above the water surface, to cattails, rushes, and shrubs reaching a height of several feet. We have a few records of *quadrimaculatus* living in running water, but these were in situations where the water was shallow and warm, and the flow extremely sluggish.

Biting records indicate that the females are crepuscular and nocturnal. On cloudy days we have noticed a tendency for the females to bite early in the afternoon, but normally they bite no earlier than shortly before dusk. Their bites are seldom painful and often go unnoticed.

This species is considered the most important carrier of malaria in the United States east of the Rocky Mountains.

**Illinois Records.**—Many larvae, collected June 2 to October 1, and many males and females, collected May 16 to November 15, are from Algonquin, Antioch, Belleville (USPHS), Benton, Bonnie, Cahokia (USPHS), Cairo (USPHS), Camp Ellis (USPHS), Camp Grant (USPHS), Carbondale, Carterville (USPHS), Caseyville, Champaign, Chanute Field (USPHS), Charleston, Crab Orchard Lake (USPHS), Danville (USPHS), Decatur (USPHS), Detroit, Dubois, Dwight (USPHS), East Alton (USPHS), East Hannibal, East Moline (USPHS), East Peoria (USPHS), East St. Louis, Edgemon, Edwardsville, Elgin, Elsah, Evansville, French Village (USPHS), Galesburg (USPHS), George Field (USPHS), Gibson City (USPHS), Gibsonia, Glendale, Gorham, Grafton (USPHS), Grand Tower, Granite City (USPHS), Hampshire (USPHS), Havana, Hecker, Herod, Herrin, Hull, Johnston City (USPHS), La Rue, Lawrenceville (USPHS), Makanda (USPHS), Marion (USPHS), Milford (USPHS), Mississippi Palisades State Park, Momence, Mound City (USPHS), Mount Vernon (USPHS), Mulberry Grove, Oakwood, Olive Branch, Olney, Omaha, Palos Park, Pere Marquette State Park, Port Byron, Rockford (USPHS), Rock Island (USPHS), St. Jacob, St. Joseph, Savanna, Scott Field (USPHS), Seneca (USPHS), Springfield (USPHS), Starved Rock State Park, Thomson, Urbana, Ursa, Vienna, Waltersburg, and Ware.

### 3. *Anopheles walkeri* Theobald

**LARVA.**—Fig. 63. In size and general color similar to *quadrimaculatus*. General structure of head and body as described for *quadrimaculatus*, except for the following differences: head hairs 2 close together, in our Illinois specimens almost always single and very long, rarely with one or two fine branches near tip. Abdomen sometimes with well-developed palmate hair on segment 2, segments 4 and 5 with hair 2 usually single and very long, rarely double or triple. The best diagnostic character found to date is head hair 3, which is densely branched from the base and therefore lacks a basal stalk.

**FEMALE.**—In color similar to *quadrimaculatus* with the exception of the palps, fig. 69, which are black with a narrow white annulation at each joint. The wing spotting is identical with that of *quadrimaculatus*.

**MALE.**—Genitalia very similar to those of *quadrimaculatus*, differing in the more slender lobe of the ninth tergite; usually the ventral lobe of the claspette has only one stout and one slender seta.

It is noteworthy that the diagnostic characters for the larvae of this species, which have been stressed by King & Bradley (1941) and by Ross & Roberts (1943), are not applicable to Illinois specimens. Following are characters listed by these authors and, in parentheses, my own observations on Illinois specimens: head hair 2 finely branched at tip (only an occasional Illinois specimen has these hairs branched and then with only one or two branches); prothoracic hair 1 branched (this hair is usually single in Illinois specimens); and hair 0 distinct and many branched (in only a rare Illinois specimen is hair 0 discernible). The densely tufted head hair 3, however, is an excellent diagnostic character, our associated larval skins indicate. This same character is well illustrated by Ross & Roberts.

This species is abundant in the marshes of extreme northeastern Illinois. Outside of this area we have Illinois records from only three widely separated localities, all from the Mississippi River valley region. These three localities are Savanna and nearby Thomson (the northwestern corner of the state), East Hannibal (almost at the center on the western margin), and Scott Field (a short distance south of the St. Louis area). All our collections have been made in cattail marshes, to which this species appears to be restricted. In the northeastern corner of the state this species is found in practically every marsh and bog in which cattails are found. The larvae have never been found there in abundance. Collecting which nets one larva per five dips is unusual; usually the proportion is closer to one larva per 20 dips. The marshes, however, are very extensive in this section, and the species is quite abundant. Unlike the females of *quadrimaculatus*, the *walkeri* females bite readily during the day as well as during the evening. In early summer they are especially vicious and will attack a person in bright sunlight.

In northeastern Illinois, adults and full grown larvae have been collected early in June and also late in October. The species has a great tolerance for cool water and is similar to *A. punctipennis* and *Culiseta inornata* in this respect.

It is interesting to note that *walkeri* is considered rare south of northern Illinois. In northern Illinois and northward, it is one of the dominant species of the anopheline populations, as shown by our Illinois collec-

tions and by studies in Minnesota and Wisconsin by Daggy, Muegge, & Riley (1941).

**Illinois Records.**—Larvae, taken May 19 to September 15, and many males and females, collected May 19 to November 1, are from Antioch, Beach, Camp Grant (USPHS), Cary, East Hannibal, Fox Lake, Franklinville, Great Lakes Naval Training Station, Lake Bluff, Lake Zurich, Orland Park, Savanna (USPHS), Scott Field (USPHS), Thomson, Volo, Wauconda, Waukegan, Woodstock, and Zion.

#### 4. *Anopheles punctipennis* (Say)

**LARVA.**—Fig. 61. Length 8 mm. Color and general conformation of hairs on head and body as for *quadrimaculatus*. Diagnostic characters as follows: head hairs 2 long and single, the pair close together at base; head hairs 3 each with multiple branching that begins some distance from the base, so that the base of the hair forms a distinct stalk; palmate hair of second abdominal segment reduced; abdominal segments 4 and 5 with hairs 2 usually double, occasionally single or triple, the single, double, or triple hairs occurring in almost any combination on different specimens.

**FEMALE.**—Body dark brown, with the mesonotum clothed with grayish scales and the wings definitely patterned with dark and cream color. Palps entirely dark without white annulations. Typical wing pattern, fig. 66, having a white costal patch near apex and a preapical white patch one-third the distance between apical spot and base of wing, this preapical spot including adjacent portions of C, R<sub>1</sub>, and R<sub>2+3</sub>; in addition there are variable areas of white scales near the base of R<sub>5</sub> and M, M<sub>1+2</sub>, M<sub>1</sub>, and M<sub>2</sub>; a diagnostic and stable area of white scales occupies most of the basal half of the anal vein.

**MALE.**—General structure and color, especially wing pattern, as for female. Genitalia in general as for *quadrimaculatus* with the following average differences in the claspette: dorsal lobe usually with only one seta, which may be round or pointed at apex; ventral lobe usually with only one stout and one narrow seta in addition to one or two short setae.

Occasional larvae are found that seem to bridge the gap between *punctipennis* and *quadrimaculatus*. The number of such larvae, however, appears so small as to be of no statistical importance in proportional



counts because 99 per cent of all the larvae taken can be identified with certainty.

Extreme variation of wing pattern has been found in Illinois material of this species. Two wing spots appear to be constant, the apical costal spot and the white bar on the base of the anal vein. All the other spots vary greatly, and occasionally additional white bars appear on practically all the radial and medial veins. The pre-apical spot is subject to the most conspicuous variation. Usually it is about one-half as long as the dark bar separating it from the apical spot. In the light extremes, the pre-apical spot may be fully as long as this dark bar; in dark extremes the preapical spot may be only a quarter or a sixth as long as the bar; and in rare instances no preapical spot may be present. Our collections indicate that there is no particular significance to these variations. We have taken a wide range of these types in a single collection from one locality, and seldom does a large collection from one locality present even a reasonable homogeneity in regard to wing spots.

In Illinois, *punctipennis* is undoubtedly the most widespread and common species of *Anopheles*. It breeds in a wider variety of aquatic situations than the other species in the genus. We have taken it in running streams, backwaters of lakes, cattail marshes, densely wooded cypress swamps, and open and practically barren pools. In southern Illinois, it is the earliest anopheline to make its appearance, the first adults usually emerging by about the middle of April. In the northern part of the state, mature larvae and pupae have been collected in the middle of October. In early spring it shows a preference for open sunlit water. In the heat of summer, at least in southern Illinois, it leaves the open situations almost entirely and breeds in fairly densely shaded situations, such as pools and creek beds, running streams, cypress swamps, or woodland pools. Both seasonal distribution and habitat indicate a preference for cooler water than that frequented by *quadrimaculatus*. In the northern part of the state this segregation is not so pronounced; here *punctipennis* and *quadrimaculatus* are frequently taken together in the same body of water.

Although *punctipennis* is extremely widely distributed, it has never been found in the tremendous local abundance that characterizes populations of *quadrimaculatus*. Evi-

dence at present indicates that *punctipennis* is not an important carrier of malaria under natural conditions, although the species becomes infected readily under experimental conditions.

**Illinois Records.**—Many larvae, collected May 14 to October 14, and many males and females, collected April 17 to November 29, are from Albion, Algonquin, Belleville (USPHS), Brubaker, Cache, Cahokia (USPHS), Cairo, Calvin, Camp Ellis (USPHS), Camp Grant (USPHS), Carbondale, Carterville (USPHS), Champaign, Chanute Field (USPHS), Charleston, Council Hill, Crab Orchard Lake (USPHS), Decatur (USPHS), Dixon Springs, Dwight (USPHS), East Alton (USPHS), East Moline (USPHS), East Peoria (USPHS), East St. Louis, Edwardsville, Effingham, Elsah, Epworth, Florence, Forest Glen, Fox Lake, Fox Ridge State Park, French Village (USPHS), Fulton (USPHS), Galesburg (USPHS), George Field (USPHS), Giant City State Park, Gibson City (USPHS), Gorham, Gossett, Grafton (USPHS), Grand Tower, Granite City (USPHS), Grantsburg, Greenville, Grimsby, Hamilton, Havana, Herod, Herrin, Joetta, Johnston City (USPHS), Jonesboro, Kankakee, Karnak, Keithsburg, Laclede, La Grange, Lake Villa, La Rue, Lawrenceville (USPHS), Lima, Maroa, Marion (USPHS), McClure, Michael, Mill Shoals, Mississippi Palisades State Park, Momence, Mount Carmel, Mount Vernon (USPHS), Mulberry Grove, Muncie, Neoga, New Athens, New Haven, Nutwood, Oakwood, Oak Park, Olney, Omaha, Palos Park, Pere Marquette State Park, Pingree Grove, Pittsburg, Pittsfield, Quincy, Richmond, Ridge Lake, Rising Sun, Rockford (USPHS), Rock Island (USPHS), Rockton, St. Jacob, St. Joseph, Salem, Savanna (USPHS), Scott Field (USPHS), Seneca (USPHS), Springfield, Starved Rock State Park, Sugar Grove, Thomson, Urbana, Ursa, Utica, Viola, Waltersburg, Ware, Waterloo, Wauconda, White Heath, White Pines Forest State Park, Willow Springs, Wolf Lake, and Zion.

##### 5. *Anopheles crucians* Wiedemann

**LARVA.**—Fig. 65. Color, size, and general conformation of hairs on head and body as for *quadrimaculatus*. Diagnostic characters as follows: head hairs 2 long and single, the pair close together at base; head hairs 3 each with multiple branching that begins some distance from base, so that the base of the hair forms a distinct stalk; palmate hair of second abdominal segment reduced; abdominal segments 4 and 5 with hairs 0 and 2 multiple and conspicuous.

**FEMALE.**—Body dark brown, the mesono-

tum clothed with linear areas of grayish scales, and the wings patterned with dark and cream color. Palps dark, with the short apical segment white and with a conspicuous white band at the base of the third segment. Typical wing pattern, fig. 67, having the costal margin entirely dark scaled except for a white patch at the apex of the wing; in addition there are areas of white scales on all the veins posterior to  $R_1$ ; a diagnostic feature is the alternation of white and dark-scaled areas on the anal vein.

MALE.—General structure and color, especially wing pattern, as for female. Genitalia very similar to those of *punctipennis* males.

In Illinois this species has been taken in numbers only in the St. Louis area and southward. Two apparent stragglers have been taken north of this area, one at Havana and one at Peoria. The species is widespread south of Illinois, and our records represent probably the northern edge of its range.

Our only larval records are from cattail marshes in the Mississippi River valley. In an extensive cattail marsh at La Rue, Illinois, this species was especially abundant. The larvae were taken in company with those of *quadrifasciatus*, which outnumbered the *crucians* larvae almost two to one. Light trap collections indicate that *crucians* is never a dominant feature of the mosquito fauna in Illinois.

ILLINOIS RECORDS.—Many larvae, collected May 22 to October 1, and many males and females, collected June 16 to October 4, are from Alton (USPHS), Cache, Cahokia (USPHS), Carterville (USPHS), Crab Orchard Lake, East Alton (USPHS), East St. Louis, Granite City (USPHS), Havana, Herrin, Johnston City (USPHS), La Rue, Marion (USPHS), Mount Vernon (USPHS), Peoria (USPHS), and Scott Field (USPHS).

## 2. *MEGARHINUS* Robineau-Desvoidy

Individuals of this genus are among the most peculiar in the state. The adults are large and brilliantly colored. The proboscis is markedly curved, as in figs. 33 and 34, not adapted for biting but for feeding on nectar. The larvae as well as the adults are very large and may be identified immediately by the small sclerotized plates upon which many body setae are situated. The larvae are restricted to tree holes, in which they are predaceous upon other mosquito

larvae. According to previous workers, the eggs are laid singly on the surface of the water.

Only a single species, *septentrionalis*, has been taken in Illinois. The only other Nearctic species, *rutilus* Coquillett, is very closely allied and has never been collected north of the extreme southeastern United States.

### 1. *Megarhinus septentrionalis*

Dyar & Knab

LARVA.—Fig. 19. Head quadrate, with well-developed mouth brushes; antennae very short, with only one or two minute setae; dorsum of head with only a few minor setae. Body hairs long and stout, each segment of thorax with one sclerotized plate bearing the dorsal lateral tuft and another bearing the ventral lateral tuft. Segments 1–7 of the abdomen with the long seta situated on tubercle-like sclerotized plates, the first segment with four on each side, the remaining segments with three, each bearing one to several long setae. Eighth abdominal segment with a large lateral sclerite bearing several long apical setae and representing the lateral comb. Air tube short and stout, with a pair of ventral tufts near base. Anal segment large, completely enclosed in a heavily sclerotized ring, and having short budlike gills and hair tufts as in fig. 19.

FEMALE.—Length of wing 7 mm. Body and appendages with metallic iridescent scales. Palps and beak a mixture of bluish-purple and gold scales, dorsum of head greenish. Mesonotum with lateral and mesal stripes of greenish gold, the intervening bands black, purple, and green. Dorsum of abdomen almost entirely greenish purple, apical segments with a few lateral patches of silvery scales; venter almost entirely creamy gold, with a mesal greenish-purple stripe. Legs, for the most part, purplish; the middle and hind tarsi with the second, third, and fourth segments white; the hind tarsi with the fourth and fifth segments white; the femora with the base and posterior face of each mostly cream. Wings entirely purple scaled. The female genitalia are dorso-ventrally compressed, fig. 57, and in this respect the species is quite unlike any other Illinois mosquito group.

MALE.—In size and general color similar to female. The tarsi are black, except for the fourth segment of the hind tarsi, which

is clothed with dirty white scales. The palps are very long and black, fig. 33. Male genitalia, fig. 47, fairly simple in general structure, resembling in many respects those of *Culiseta*; differing most markedly in the shape of the dististyle and ninth tergite.

We have only a few scattered records of this species, all from the southern third of the state. Our records from Carbondale are based on captures of free-flying adults; specimens from Scott Field and Edwardsville were collected as immature stages in tree holes in oak-hickory woods. The species has been reported as widespread throughout the southeastern states.

**Illinois Records.**—CARBONDALE: Aug. 7, 1927, 1 ♀; 1941, 2 ♂; EDWARDSVILLE: Sept. 24, 1943, from tree hole, 1 ♀; SCOTT FIELD: Aug. 13, 1942, tree hole, 2 larvae; Aug. 24, 1942, fallen-tree hole, 1 ♂; Sept. 16, 1942, tree hole, 1 larva.

### 3. *URANOTAENIA* Arribáizaga

Individuals in this genus are small. Both adults and larvae present a number of distinctive characters that set them off readily from other mosquitoes in Illinois. Of the three species of *Uranotaenia* known to occur in North America, only one has been taken in Illinois.

#### 1. *Uranotaenia sapphirina* (Osten Sacken)

**LARVA.**—Fig. 72. Length 5 mm. Head elongate, the upper and lower head hairs represented by long stout spines. Antennae short with a few sharp spines at apex. Thorax and first two segments of abdomen with long stout lateral hairs, abdominal segments 3–7 with only fine tufts of hairs. Lateral comb of eighth segment represented by a large sclerotized plate bearing a row of 8 to 10 teeth on its apical margin. Air tube elongate and slender, the pecten distinct and containing about 15 spines, the ventral tuft large and situated at the end of the pecten. Anal segment longer than deep, completely encircled by the sclerotized ring, the anal gills finger-like, slender, but only about as long as the anal segment.

**FEMALE.**—Length of wing 2.5 mm. Palps minute and budlike. Head and thorax, including beak, dark-brown scaled; dorsum of head, antero-lateral lobe of pronotum, patches of scales on the pleurae, a narrow line on the extreme edge of the mesonotum,

and a narrow mesal line down the pronotum, from near the anterior margin to the tip of the scutellum, bright iridescent blue. Abdomen dark brown with irregular apical patches of dirty white scales at the apex of some segments. Legs dark brown, each with a small conspicuous knee patch and a small patch on upper side of tip of tibia, each patch consisting of a cluster of white scales. Wings brown scaled, except for a line of blue scales covering the stem of Cubitus. All the brown scales of the wings and legs are iridescent, appearing greenish blue in certain lights.

**MALE.**—Similar in size and general structure to female; in this sex also the palps are small and budlike, fig. 32. Genitalia, fig. 44, with basistyle short and robust and with a cluster of five or six longer spines on the mesal face; dististyle short, the apex narrowed and hooked, without conspicuous apical seta. Ninth tergite developed into a very large bilobed plate that extends over the tenth segment and mesosome.

The larvae of this species, which is widespread in Illinois, live in permanent or semi-permanent ponds, preferring weed-choked situations. In northern Illinois they occur in several cattail marshes and in southern Illinois are usually associated with dense marginal growths of *Jussiaea*, especially

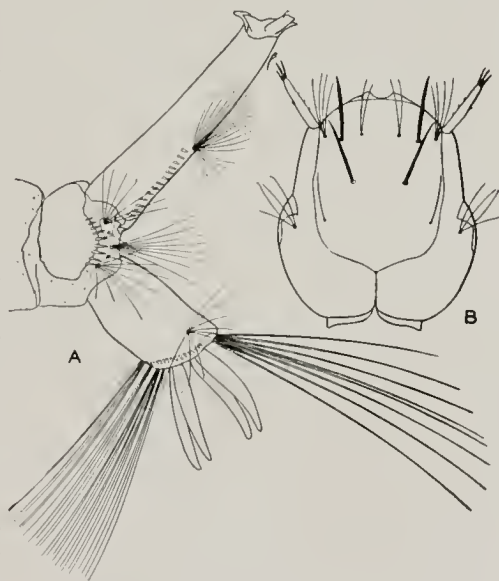


Fig. 72.—*Uranotaenia sapphirina*, larva. A, apex of abdomen, lateral aspect; B, dorsum of head.



where this plant occurs in combination with cattails or other marsh plants. They are very much like anopheline larvae in peculiarities of movement when diving or coming to the surface. The species appears fairly late in the season, apparently in response to the warmer waters of the summer season. The adults apparently do not bite. Presumably they feed on nectar. The females lay eggs in irregular rafts on the surface of the water.

This species has a wide range that embraces most of the United States east of the Great Plains and has at least scattered records from Minnesota to the extreme southern states. It has been reported from southern Illinois by both Chandler (1920) and Matheson (1930) and from various localities in the Chicago area by Gerhard (1910).

**Illinois Records.**—Larvae, collected June 3 to August 27 and many males and females, collected May 23 to October 21, are from Cahokia (USPHS), Cairo (USPHS), Camp Grant (USPHS), Carterville (USPHS), Chanute Field (USPHS), Charleston, Crab Orchard Lake (USPHS), East Hannibal, East St. Louis, Edwardsville, Effingham, Elgin, Elsah, Fox Lake, Fox Ridge State Park, Gibsonsia, Gossett, Grafton (USPHS), Granite City (USPHS), Great Lakes Naval Training Station, Havana, Hecker, Herod, Herrin, Homer, Johnston City (USPHS), Lake Glendale, La Rue, Marion (USPHS), Mount Carmel, Mount Vernon (USPHS), Muncie, Oakwood, Omaha, Ottawa, Peoria (USPHS), Putnam, Raymond, Salem, Savanna, (USPHS), Scott Field (USPHS), Seneca (USPHS), Springfield (USPHS), Starved Rock State Park, Sugar Grove, Thomson, Urbana, Volo, Wauconda, and White Pines Forest State Park.

#### 4. *WYEOMYIA* Theobald

This genus is represented in Illinois by only the pitcher plant mosquito, *smithii*. The males are readily identified by the curious shape of the dististyle, fig. 46. The larvae, fig. 20, have very distinctive characters in the structures of the terminal segments.

##### 1. *Wyeomyia smithii* (Coquillett)

**LARVA.**—Fig. 20. Length 6 mm. Head longer than wide, somewhat ovate, antennae short, without conspicuous lateral tufts. Dorsum of head with only a few indistinct hairs. Body hairs very long. Eighth segment with a lateral comb consisting of about eight scales arranged in a straight

row. Air tube small, slender, with about 15 pairs of long single hairs scattered along its length. Anal segment almost ringed by the sclerotized plate. The apex of this plate bears dorsally two pairs of long double hairs and a single pair of lateral double hairs; at the postero-ventral corner of the plate is a pair of double or triple hairs. No ventral brush is present. The anal gills, two in number, are large and sausage shaped; a second pair of gills may be represented by a pair of small swellings above the base of the conspicuous gills.

**FEMALE.**—Length of wing 3 mm. Beak, dorsum of head, mesonotum, and dorsum of abdomen almost uniformly covered with a mat of iridescent bluish-black scales. Pleurae and venter uniformly covered with creamy or silver scales. Scales of mesonotum forming a dense appressed mat without setae projecting above it, but with setae projecting from beneath it at the sides and along the posterior margin. Postnotum with a small cluster of minute setae. Legs, for the most part, blue black, whitish blue beneath, iridescent; the middle pair may have the apical two or three segments predominately white scaled, at least on the outer face. Wings uniformly deep bluish-brown scaled.

**MALE.**—Similar in size, color, and structure to female. The palps are short and abortive as in female. The male genitalia, fig. 46, have a long slender basistyle and are distinguished from those of all other Illinois mosquitoes by the curious processes of the dististyle.

In Illinois this little mosquito is found only in the tamarack bogs of the northeastern corner of the state. The larvae live in the water contained in the pitchers of the pitcher plant, *Sarracenia purpurea* Linnaeus. The species overwinters as larvae in the pitcher plants, and the adults emerge the following summer. The females, which lay eggs in the pitchers, apparently do not bite. The adults are quite active during the day, flying around the pitcher plants. They are very difficult to follow in flight; they have an irregular and slow flight pattern that combines with the gangling legs and iridescent color to make it difficult for an observer to be sure just how far away they are. The development of the larvae is apparently very slow. In this respect the pitcher plant mosquito resembles the tree hole species.

The range of the species includes most of



the northeastern states, wherever the pitcher plant occurs. Two other species in the genus occur in southern Florida. A key to the females is given by Roth (1946).

**Illinois Records.**—CEDAR LAKE: in bog, Aug. 3-6, 1906, Shobe, 3 ♀; Aug. 6, 1906, 1 ♂; Aug. 7, 1906, 7 ♂, 22 ♀. McHENRY: Nov. 10, 1927, in pitcher plant, H. H. Ross, 3 larvae. VOLO: in pitcher plant, July 1, 1942, Ross & Mohr, 3 larvae; July 3, 1942, Ross & Mohr, 15 larvae; July 8, 1942, Ross & Mohr, 2 ♀, 2 pupal skins; July 19, 1942, Ross & Mohr, 12 ♂, 1 ♀; Oct. 27, 1943, Ross & Sanderson, 1 ♂.

### 5. *MANSONIA* Blanchard

Modifications in the larva make this genus of unique interest. The larval air tube forms a sharp piercing structure that is inserted into the roots or underwater stems of vascular plants; it pierces the air chambers of these, and the larva draws on the air in these chambers for its respiration. Thus, the larva does not need to come to the surface for air. Otherwise the larva and the adult are very similar to those of allied mosquitoes. The eggs are laid as rafts on the surface of the water. A single species, *perturbans*, occurs in Illinois. The only other United States species are the tropical *titillans* (Walker) and *indubitans* Dyar & Shannon, which are found in southern Florida (Pratt 1945). The species *perturbans* is placed in the subgenus *Coquillettidia* Dyar.

#### I. *Mansonia perturbans* (Walker)

**LARVA.**—Fig. 73. Head wider than long, antennae slender and long, with a fan-shaped tuft near middle; dorsum of head with many multiple tufts. Thorax and abdomen with many long setae. Eighth segment with an irregular row of scales forming the comb. Air tube, fig. 18, with a wide base, the apical sclerites long and sharp, forming a stout piercing organ. Anal segment fairly narrow, completely encircled by a sclerotized ring; anal gills pointed, shorter than segment.

**FEMALE.**—Length of wing 4.5 mm. Beak with a mixture of brown and pale scales, the latter forming an indistinct central ring. Dorsum of head and mesonotum with brown scales and hair, the mesonotal setae abundant, long and recurved. Abdomen with a mixture of pale and brownish-blue scales, the former predominating at the base of the

segment, the latter predominating at the apex. Femora and tibiae with an irregular mixture of brown and pale scales, the posterior face of femora chiefly cream scaled; tarsal segments 2-5 each having the basal half white scaled, the apex black scaled; basitarsi with a narrow basal band of white scales and an irregular central band of white scales. Wings with an indiscriminate mixture of white and brown scales, the scales all broad.

**MALE.**—In size, color, and general structure similar to female. Palps longer than beak, the apex of the second segment and the entire third and fourth segments with a ventral brush. Genitalia, fig. 43, with ninth tergite strap shaped and having a pair of conspicuous ventral lobes. Basistyle fairly stout, its mesal face with few setae and with a single long stout beaklike spine. Dististyle twisted and angulate at base, narrow, expanded, and bladelike at apex, its apical spine forming a stout sharp tip. Lobes of tenth sternite moderately long and evenly toothed. Mesosome short and stout, with a row of stout but minute dorsal teeth.

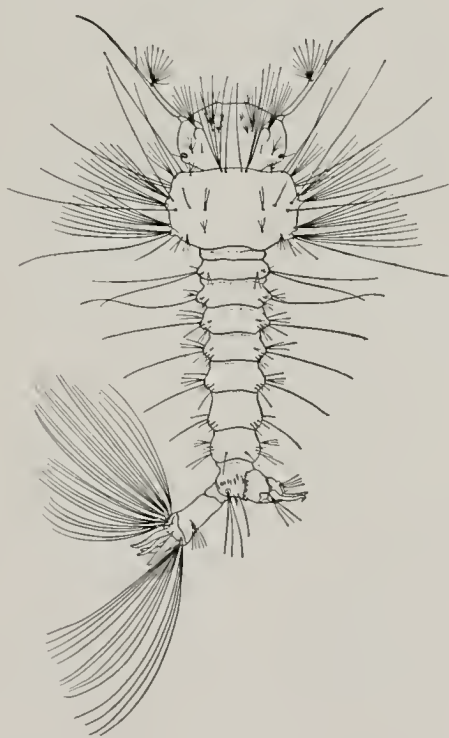


Fig. 73.—*Mansonia perturbans*, larva. (After Matheson.)

Taken in only a few areas of the state, this species is most commonly encountered in the marshes of the extreme northeastern corner and south to the Chicago area. A few other records have been taken extending to the southern third of the state. Adult records occur from June through August. Males have been taken only in the early part of this period and suggest that there is only a single generation per year in Illinois. The species is associated chiefly with cattails and aquatic sedges. In the southern states, pickerelweed, arrowhead, and other plants are frequently preferred for larval attachment.

The females are voracious biters, especially in the cloudy afternoons and the crepuscular periods.

Gerhard (1910) recorded this species as common and annoying in tracts of woodland in the Chicago region and encountered rarely on the south side of the city. Specimens from Roxana, Danville, and also Algonquin were recorded by Matheson (1930). J. Lyell Clarke has told me of occasional swarms of this species which were very annoying to the workers in several industrial plants on the south side of Chicago.

The species is widely distributed throughout the eastern United States, from Minnesota to Florida.

**Illinois Records.**—Adults, collected May 21 to September 19, are from Algonquin, Beach, Belleville (USPHS), Cahokia (USPHS), Camp Grant (USPHS), Carterville (USPHS), Danville, East St. Louis, Elsah, Grand Tower, Granite City (USPHS), Great Lakes Naval Training Station, Herrin, Johnston City (USPHS), Marion (USPHS), Oak Park, Peoria (USPHS), Pere Marquette State Park, Roxana, Savanna, Starved Rock State Park, Volo, and Zion.

## 6. *ORTHOPODOMYIA* Theobald

The Illinois species of this genus are characterized by the curious mesonotal pattern of the adults, fig. 27, and by the air tube, basal sclerite, and anal segment of the larva, fig. 17. Two species are known from Illinois, both of which occur only in tree holes. The status of these two species is very puzzling. To date no distinguishing characters have been discovered either in coloration of the external areas or in the structure of the male genitalia. The larvae, however, differ quite markedly both in color and in the average sclerotization of the seventh and eighth abdominal segments. Larvae of both

species are practically identical in chaetotaxy and formation of the lateral comb.

It has been suggested that the color of the base of the abdomen would separate these two forms in the adult stage. Isolated rearings have demonstrated that this difference does not hold, at least for Illinois specimens. It is therefore impossible at present to give a key for the specific diagnosis of males or females.

### KEY TO LARVAE

- Head medium to dark brown, body pink; segments 6, 7, and 8 usually with dorsal sclerotized plates, the plate of segment 8 frequently extending ventrad to the ventral margin of the comb, fig. 17; these sclerotized plates may be entirely absent. . . . . 1. *signifera*  
Head capsule very pale yellow to white, body white to straw color; segments 6, 7, and 8 without sclerotized plates. . . . . 2. *alba*

### 1. *Orthopodomysia signifera* (Coquillett)

**LARVA.**—Fig. 17. Length 7 mm. Head dark brown, somewhat oval, slightly longer than wide; upper and lower head hairs multiple and fan shaped, the lower hairs close to the uppers and more laterad than anteriorly; between them is a pair of shorter fanlike tufts. Thorax and abdomen with many long hairs. Seventh abdominal segment frequently with a large dorsal sclerotized shield, which may be reduced to a pair of small dorsal sclerites or even be entirely absent. Eighth segment usually with a large dorsal sclerotized shield; this may be so large that it extends to the ventral end of the lateral comb but it may be much smaller or in rare individuals practically absent. Lateral comb consisting of two distinct series of scales, an anterior row of 15 to 20 small scales and a posterior row of about 5 very large long scales. Air tube about three times as long as wide, having no pecten but having a large ventral tuft just before middle. Anal segment with a basal barlike sclerite, the main portion of the segment completely surrounded by the sclerotized ring and with pointed gills, the upper pair much longer than the segment, the lower pair about as long as the segment.

**FEMALE.**—Length of wing 4 mm. Entire body principally dark brown to black scaled, dull and velvety. Beak and palps with irregular rows of white scales, dorsum of head

with scattered white scales and a prominent row around posterior margin of eyes. Mesonotum with narrow but sharp lines of white scales, fig. 27. First abdominal tergite and base of second usually white scaled. Femora with a scattering of white scales, tibiae with irregular lines of white scales. Tarsi black, the anterior pair with a minute white patch at end of basitarsus, the middle pair with patches of white at base of apex. Basitarsus and the hind pair with basal apical patches on the first four tarsal segments and on the dorsum of the last segment. The white bands on only the first two tarsal segments of the hind legs are wide enough to form conspicuous bands. Wings with a conspicuous mottling of white scales that form definite patches on the base of the anal vein and around the point where  $R_{2+3}$  and  $R_{4+5}$  divide from each other.

MALE.—Size, color, and general structure essentially as for female. Palps elongate, as long as beak, black scaled, without tufts, but apical segment with 15 or 20 fairly long stiff setae projecting irregularly on all sides. Male genitalia as in fig. 45. Ninth tergite mostly membranous, without definite ventral lobes. Tenth sternite of medium length, ending in a series of three or four closely appressed teeth. Mesosome about as long as tenth sternite, with short lateral teeth near apex. Basistyle elongate, with a ventral mesal cluster of stout setae; at its base is a mesal arcuate lobe that bears an even cluster of stout setae. Dististyle slender and elongate, tipped with a short stout seta that is truncate at apex, the end apparently with a cone-shaped hollow.

Widely distributed over Illinois, this species breeds exclusively in tree holes. The eggs are laid singly at the water's edge and hatch in a few days. As seems true with all the tree hole mosquitoes occurring in this latitude, the larvae apparently grow rather slowly. Emergence of adults begins toward the end of June and continues through the summer. Apparently females of the species bite humans only on rare occasions and are not a pest. Superficially the adult resembles the yellow-fever mosquito, *Aedes aegypti*. The adults can usually be found most readily sitting in and around tree cavities.

The species is widely distributed throughout many of the eastern states, although it does not occur much farther north than Illinois.

To date, all but one of the larval colonies of this genus that we have encountered in Illinois have been those of *signifera*. For this reason we have tentatively considered all field-collected adults of *Orthopodomyia* to be of this species.

This species was reported from the Chicago area by Gerhard (1910) as *Bancroftia signifera* and from Urbana by Matheson (1930).

ILLINOIS RECORDS.—Larvae, collected June 29 to July 3, and adults, collected June 5 to September 30, are from Cahokia (USPHS), Des Plaines, East St. Louis, Galesburg, Glencoe, Havana, Mahomet, Onarga, Ridge Lake, Scott Field (USPHS), Thebes, and Urbana.

## 2. *Orthopodomyia alba* Baker

Similar to *signifera* in adult characters and in general characteristics of the larva; differing as outlined in the key. Only a single colony of this species has been encountered in Illinois. It was found in a tree hole—in a soft maple tree at Onarga, where it occurred with *signifera*. This dual colony has persisted for several years, the *alba* larvae slightly more abundant than the *signifera* larvae. Individual rearings from this colony established the similarity in color of the adults of the two forms.

## 7. *CULISETA* Felt

Only two species of this genus have been taken in the state. A third species, *melanura* (Coquillett), is widespread to the east and south. The few remaining species of the genus are northern or western in distribution. The eggs are laid in rafts on the surface of the water. The adults resemble large specimens of *Culex*, but the larvae are readily distinguished from other mosquito larvae by the large basal tuft on the air tube.

### KEY TO SPECIES

#### LARVAE

- Tube short and stout, fig. 74. . . . . 1. *inornata*  
Tube longer and slender, fig. 75. . . . . 2. *morsitans*

#### FEMALES

- Tarsi without pale rings on the segments. . . . . 1. *inornata*  
Tarsi with faint whitish rings at both ends of the segments. . . . . 2. *morsitans*

#### MALES

- Mesosome consisting of a pair of long, slender black rods tipped with a small membranous piece, fig. 78. . . . . 1. *inornata*



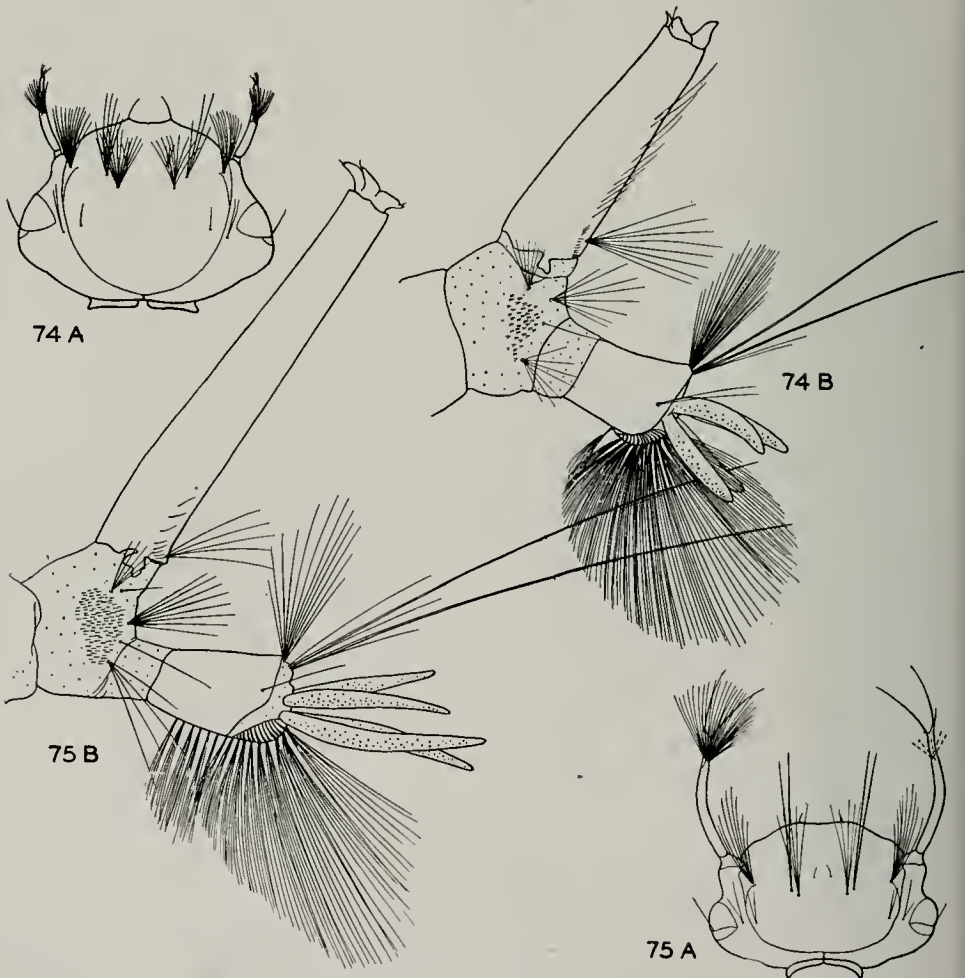
Mesosome wide, bulbous in central portion and only lightly sclerotized, fig. 77. . . . .  
 . . . . . 2. *morsitans*

1. *Culiseta inornata* (Williston)

LARVA.—Fig. 74. Length 10 mm. Head capsule wider than long, upper and lower head hairs fan shaped, the lower ones usually quadruple, the upper ones with about eight rays; in front of the upper hairs is an accessory pair of tufts, each with about four hairs. Hairs of thorax and abdomen of only medium length. Eighth segment with a triangular comb consisting of about 50 scales. Air tube fairly long, a little over three times

as long as wide; pecten long, the basal 10 to 12 scales sclerotized and dark, the remainder longer, hairlike, and almost colorless; ventral tuft composed of about eight long stout hairs situated near the base of the air tube on the ventral aspect mesad of the pecten. Anal segment completely encircled by sclerotized ring; anal gills long and tapering, longer than segment.

FEMALE.—Wing length 6 mm. Beak, head, mesonotum, and most of legs a mixture of brown and gray scales; pleurae, venter of abdomen, and ventral face of most of legs with gray or cream-colored scales predominating. Dorsum of abdomen with basal bands of cream and tawny scales, apical



Larvae of *Culiseta*

Fig. 74.—*C. inornata*: A, dorsum of head;  
 B, apex of abdomen.

Fig. 75.—*C. morsitans*: A, dorsum of head;  
 B, apex of abdomen.



portion brown scaled. Wings mostly brown scaled but with a mixture of tawny scales along most of the anterior veins. In some specimens Costa and Radius almost entirely tawny scaled; in these the legs may be predominantly tawny scaled throughout.

MALE.—Form slender compared to that of female. Pattern in general similar to

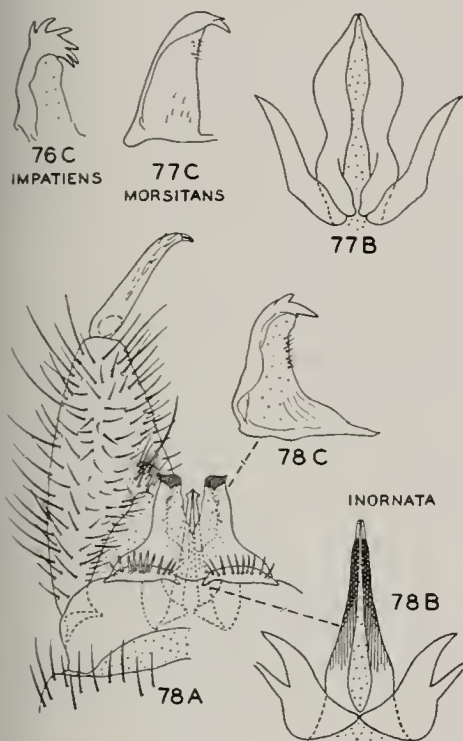
composed of two long sclerotized plates with a slender membranous tip.

One of the common marsh mosquitoes in Illinois, this species is most abundant in the northeastern quarter of the state, where it is found in numbers in almost every marsh. Farther south it occurs in marshes, sink holes, stump holes, and artificial ponds. In Illinois the species apparently has an early spring and late summer generation with a fairly definite period of inactivity during the hottest period of the summer. The two-brooded condition is especially pronounced in southern Illinois, where the first wave of adults comes out in April and early May and the next in September and October. The eggs are laid as rafts on the surface of the water. The adults apparently overwinter and are frequently encountered entering houses, presumably to hibernate, during warm days of November and December. In early spring the overwintered females bite ferociously, but during the summer this species does not seem to constitute much of a pest even in those regions where it is abundant.

Very common throughout almost the entire United States, the species is essentially a winter form in the extreme southeast, according to King, Bradley, & McNeel (1939); in higher elevations of the Rocky Mountains it is primarily a midsummer form. Illinois presents an interesting intermediate between these two extremes.

The species was recorded from the vicinity of Chicago under the name *Culiseta consobrinus* (Robineau-Desvoidy) by Gerhard (1910). Matheson (1930), who recorded it as common and widespread in Illinois, listed several localities. In the same paper he listed a male from Carbondale, Illinois, as *Theobaldia impatiens* (Walker); the cleared genitalia of this specimen show that it is a typical specimen of *Culiseta inornata*.

Illinois Records.—Larvae, collected April 6 to October 22, and adults, collected March 16 to November 16, are from Algonquin, Alton, Amboy, Antioch, Cache, Cahokia (USPHS), Cairo (USPHS), Camp Grant (USPHS), Carbondale, Carterville (USPHS), Cottage Grove, Crab Orchard Lake (USPHS), Dupo, Durand, East Moline (USPHS), East Peoria (USPHS), East St. Louis, Effingham, Eldorado, Elk Grove, Elsah, Farmer City, George Field (USPHS), Gilman, Glencoe, Grand Tower, Granite City (USPHS), Grantsburg, Great Lakes Naval Training Station, Harrisburg, Havana, Hazelcrest, Herod, Herrin, Highland, Hinsdale, Kau-



Figs. 76-78.—Male genitalia of *Culiseta*. A, genital capsule, ventral aspect; B, mesosome, dorsal aspect; C, lobe of tenth sternite, lateral aspect.

that of female but with the cream and tawny scales replaced almost entirely by lemon scales, with little or no banding on the dorsum of the abdomen but with the eighth tergite almost entirely yellow scaled. Palps longer than beak, slender, and without conspicuous brushes, both palps and beak largely yellow scaled, except at tip. Genitalia, fig. 78, with basistyle fairly long, robust, and tapering, with a small meso-basal area bearing a dense patch of setae. Dististyle slender, tipped with a pair of short stout tooth-like setae. Lobes of tenth sternite ending in a few sharp teeth, much fewer than in *impatiens* (Walker), fig. 76. Mesosome

kakee, Karnak, Keithsburg, Makanda, Marion (USPHS), McLean, Mazon, Mill Shoals, Mississippi Palisades State Park, Momence, Mount Vernon, Mount Zion, Muncie, Neoga, New Boston, Orland Park, Palatine, Palos Park, Pere Marquette State Park, Ravinia, Rockton, Roxana, St. Jacob, Savanna (USPHS), Scott Field (USPHS), Seneca (USPHS), Springfield (USPHS), Starved Rock State Park, Urbana, Wadsworth, Waltersburg, Ware, Waukegan, White Heath, Willow Springs, Wolf Lake, Woodstock, and Zion.

## 2. *Culiseta morsitans* (Theobald)

LARVA.—Fig. 75. Length 9 mm. Head very wide, almost rectangular. Upper head hairs usually four or five branched, lower head hairs double and extremely long; between them is a pair of extremely minute hairs. Antennae long and curved with a large tuft near apex. Thorax and abdomen with many very long hairs. Eighth segment with large triangular lateral comb consisting of about a hundred minute scales. Air tube extremely long and slender, nearly seven times as long as wide; pecten consisting of only a few flat teeth on basal fourth; ventral tuft on ventral margin at extreme base. Anal segment entirely enclosed by sclerotized ring, with hairs of ventral brush arising through ring; anal gills slender and pointed, about as long as segment.

FEMALE.—Length of wing 5 mm. Color dark bluish brown, the dorsum of head mostly gray scaled, mesonotum with a few small spots and lines of gray scales. Dorsum of abdomen with a basal gray band on each segment, the apical portion of the segments brown scaled. Legs almost entirely bluish-brown scaled with faint but distinct narrow rings at the base of most of the tarsal segments. Wings entirely blue-brown scaled.

MALE.—Similar in size and color to female. Palps elongate, differing markedly from those of *inornata* in having long ventral brushes at the apex of the second and on all of the third and fourth segments. Genitalia similar in general outline to those of *inornata*, differing markedly in the shape of the mesosome, which is bulbous, sinuate, and not heavily sclerotized, fig. 77.

This is a northern species, which we have taken in Illinois only in a tamarack bog near Antioch. A single larva was taken on the edge of the bog, June 4, 1943, Ross & Sanderson; subsequent collecting during the same year failed to disclose additional

specimens. The next year the bog was visited on April 19, and scattered specimens of the larva were found in the cool, shaded pools around the base of the old tamarack hummocks. Efforts to rear some of these specimens were not successful. The specimens were transported to Urbana, where at the time fairly high temperatures prevailed, and all the larvae died. It is interesting to note that larvae of several species of *Aedes*, brought back at the same time and given the same treatment, emerged without difficulty. On a subsequent visit to the bog on May 19, 1944, larvae were found in the same place and apparently completely full grown. On this occasion, jars in which larvae were placed were wrapped in moist cloths for the trip to Urbana and afterwards were kept in a water bath at a temperature of about 60 degrees F. These larvae matured and transformed slowly but successfully.

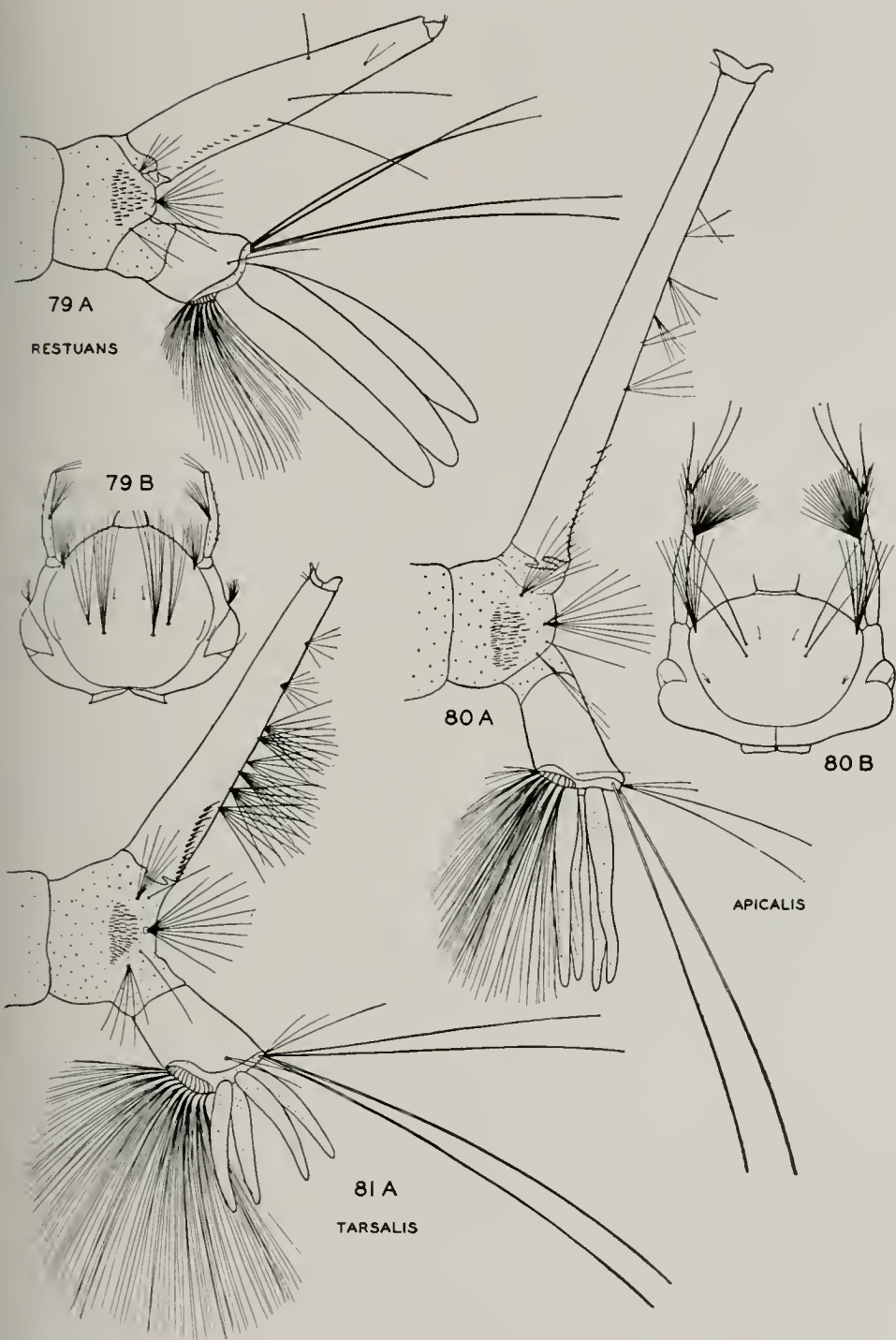
Although no other records for Illinois have been taken, we have in the collection a female from Lake Delavan, Wisconsin, and two females from Minocqua, Wisconsin, which are of this same species; these were incorrectly recorded as *impatiens* (Walker) by Matheson (1930).

## 8. *CULEX* Linnaeus

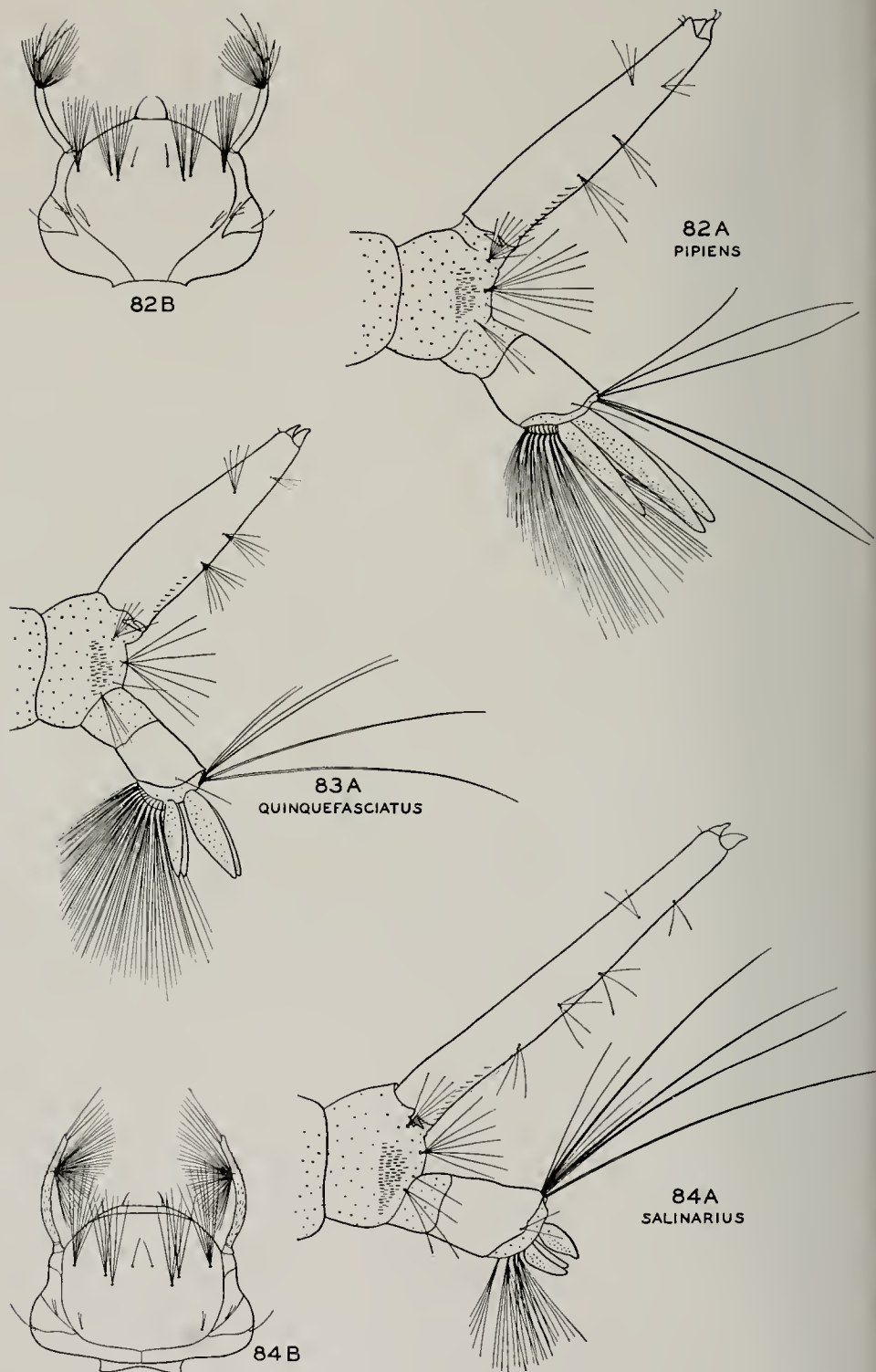
The eight species of this genus that occur in Illinois have a continual series of generations throughout the warmer months of the year. The females lay their eggs in rafts on the surface of the water. The species frequent still or semistagnant water of all types and may be found even in lakes of some size, the larvae breeding in masses of floating or emergent vegetation. Usually the larvae are taken in association with anopheline larvae.

The genus as a whole is tropical or subtropical in distribution. Many North American species occur in the southeastern states, southwest Texas, and southern California. In the Neotropical region, the genus is represented by a very large number of species.

During the period 1941–1945 concerted investigations of the mosquito fauna of the southern areas of the United States led to the discovery of several species of *Culex* hitherto recorded only from the Neotropical region. A digest of these and allied Nearctic species is given in two papers, one by W. W. Wirth (1945) and the other by



Figs. 79-81.—Larvae of *Culex*. A, apex of abdomen, lateral aspect; B, dorsum of head. In figs. 81 and 85, the ventral tufts are shown for both sides of the air tube. In other illustrations, tufts of only one side are shown.



Figs. 82-84.—Larvae of *Culex*. A, apex of abdomen, lateral aspect; B, dorsum of head.



Pratt, Wirth & Denning (1945). These papers supplement the work of Roth (1943) on the Nearctic species of *Culex*.

The genus is divided into many subgenera, three of which are represented in Illinois.

KEY TO SPECIES

LARVAE

- 1. Antennal tuft near middle, fig. 79 . . . . . 2. *restuans*
- Antennal tuft considerably beyond middle, fig. 80 . . . . . 2

- Comb scales forming a patch; body only sparsely spiculose; upper head hairs double or triple . . . . . 8. *peccator*
- 5. Air tube very long and slender, fig. 84, from six to eight times as long as width at end of pecten; tufts scattered and weak . . . . . 5. *salinarius*
- Air tube either not more than five times as long as wide, fig. 82; or with strong, clustered tufts, fig. 81 . . . . . 6
- 6. Air tube usually six times as long as width at end of pecten, sinuate but of almost uniform thickness throughout, and with

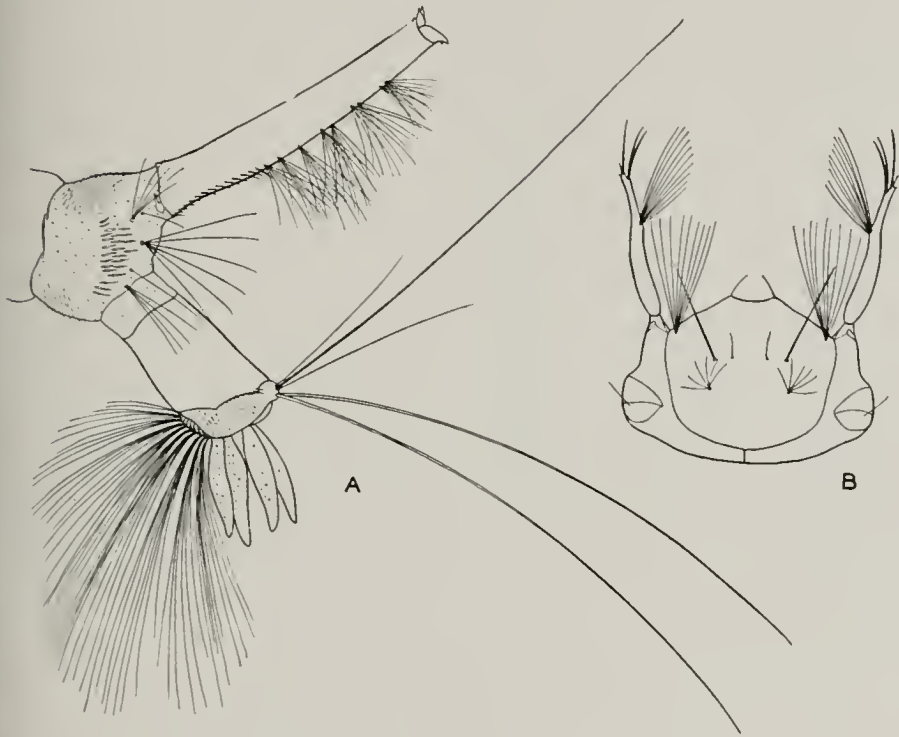


Fig. 85.—*Culex erraticus*, larva. A, apex of abdomen; B, dorsum of head.

- 2. Both pairs of head hairs long and single, an occasional hair double, fig. 80 . . . . . 1. *apicalis*
- One or both pairs of head hairs either multiple, fig. 82, or very short, fig. 85 . . . . . 3
- 3. Lower head hairs long and single, upper short and double to multiple, fig. 85 . . . 4
- Lower head hairs triple to multiple, similar to upper head hairs, both pairs long, fig. 82 . . . . . 5
- 4. Comb scales arranged in an irregular single or double row; body densely spiculo-pilose; upper head hairs each with four or more branches; fig. 85 . . . . . 7. *erraticus*

- all tufts near ventral margin, fig. 81 . . . . . 6. *tarsalis*
- Air tube usually three and one-half to five times as long as width at end of pecten, somewhat vasiform, definitely thickest near end of pecten; penultimate tuft distinctly more dorsal than, and out of line with, the others, fig. 82 . . . . . 7
- 7. Air tube usually four to five times as long as wide; two basal pairs of hair tufts with a maximum of three or four branches each, fig. 82 . . . . . 3. *pipiens*
- Air tube usually less than four times as long as wide, two basal pairs of hair tufts with 5 to 10 branches each, fig. 83 . . . . . 4. *quinquefasciatus*

## FEMALES

1. Beak and hind tarsi with white bands; mesonotum with white lines, fig. 86*A*. . . . .6. *tarsalis*  
Beak and hind tarsi entirely dark; mesonotum with pale dots but without white lines on central portion. . . . .2
2. Dorsum of abdomen with apical white bands or apical lateral spots on some of the segments, and without basal bands. . . . .1. *apicalis*  
Dorsum of abdomen with basal bands but no apical bands. . . . .3

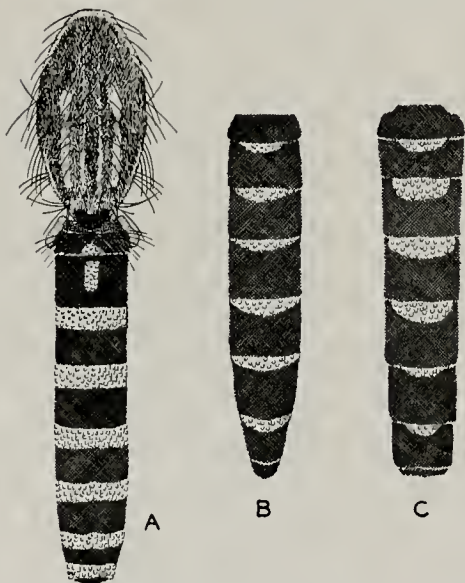


Fig. 86.—Dorsum of *Culex* females. *A*, *C. tarsalis*, thorax and abdomen; *B*, *C. pipiens*, abdomen; *C*, *C. quinquefasciatus*, abdomen.

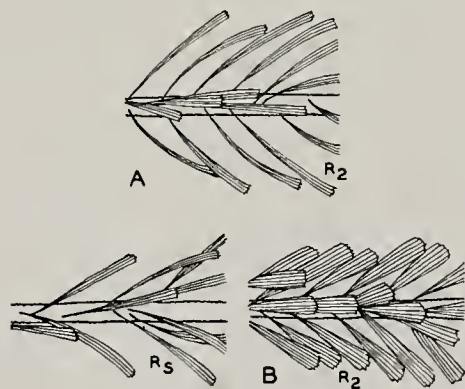
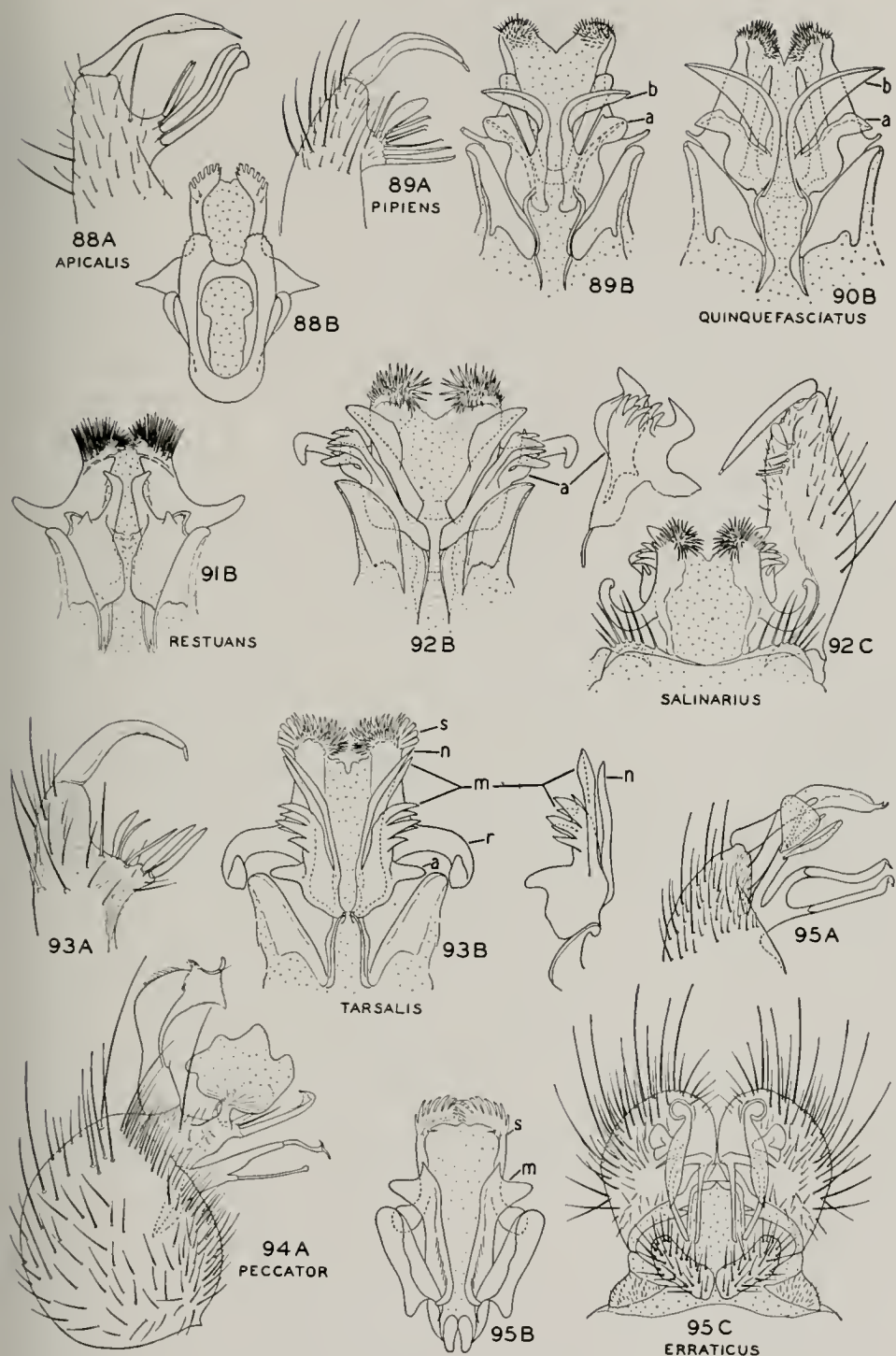


Fig. 87.—*A*, *Culex restuans*, scales on wing vein  $R_2$ ; *B*, *C. erraticus*, scales on wing vein  $R_s$  and  $R_2$ .

3. Scales of veins  $R_2$  and  $R_3$  very long and slender, fig. 87*A*, similar to scales on stem of  $R_s$  (examination of wing mount under a compound microscope is best method for seeing this character) . . . . .4  
Scales of veins  $R_2$  and  $R_3$  shorter and wide, fig. 87*B*, contrasting with long, slender scales on stem of  $R_s$  . . . . .7
4. Abdominal tergites with dingy basal bands of yellowish or brownish scales, the bands usually irregular and narrow . . . . .5. *salinarius*  
Abdominal tergites with bright and conspicuous basal bands of white scales, the central bands wide, fig. 86*B*, *C* . . . . .5
5. Abdominal dorsal white bands usually deep and crescentic, the bands not extending to edge of dorsum, fig. 86*C* . . . . .4. *quinquefasciatus*  
Abdominal dorsal white bands usually shallower, fig. 86*B*, or with posterior margin straight, extending to edge of dorsum . . . . .6
6. Mesonotum usually with a pair of central pale spots. . . . .2. *restuans*  
Mesonotum always without any pale spots . . . . .3. *pipiens*
7. Occiput with a large mesal triangle of narrow scales, the area between this triangle and eyes covered with wide, overlapping scales. . . . .7. *erraticus*  
Occiput entirely covered with wide overlapping scales except occasionally for a narrow mesal line of narrow scales. . . . .8. *peccator*

## MALES

1. Basistyle globular and short; subapical lobe divided into two or three individual long stalks, figs. 94, 95 . . . . .2  
Basistyle elongate, tapering at apex; subapical lobe only slightly, if at all, subdivided, figs. 88–93 . . . . .3
2. Dististyle narrow and only slightly curved; subapical lobe with upper stalk slender, leaflet regular in shape and of moderate size, fig. 95 . . . . .7. *erraticus*  
Dististyle wide, abruptly angled just beyond middle; subapical lobe with upper stalk stout, leaflet very large and with irregular outline, fig. 94 . . . . .8. *peccator*
3. Middle mesosomal plates armed with a cluster of stout sclerotized teeth, figs. 92, 93 . . . . .4  
Middle mesosomal plates not toothed, in some species not evident, figs. 88–91 . . . . .5
4. Inner mesosomal plates with apical half expanded; middle plates with basal projection, *a*, curved back and up under teeth, fig. 92, and without a ventral blade paralleling inner plates. . . . .5. *salinarius*



Figs. 88-95.—*Culex*, male genitalia. *A*, claspers, lateral aspect; *B*, mesosomal structures, dorsal aspect; *C*, ventral view of capsule. Abbreviations: *s*, apex of tenth sternite; *r*, basal arm of tenth sternite; *m*, middle and, *n*, inner mesosomal plates; *a* and *b*, as in text.

- Inner mesosomal plates narrow and blade-like, apex curved laterad and paralleled by a ventral blade of middle plates; middle plates with basal projection, *a*, projecting only laterad, fig. 93. . . . . 6. tarsalis
5. Inner mesosomal plates forming a V- or U-shaped structure, middle mesosomal plates also well developed, terminating in a sickle-shaped process, figs. 89, 90. . . . . 6
- Inner and middle mesosomal plates not separate from each other, together represented by a single structure, figs. 88, 91. . . . . 7
6. Rods of inner mesosomal plates divergent, forming a V-shaped structure, fig. 89. . . . . 3. pipiens
- Rods of inner mesosomal plates convergent, forming a U-shaped structure, fig. 90. . . . . 4. quinquefasciatus
7. Inner mesosomal plates with apexes forming a pair of stout rods curved laterad at apex, fig. 91; brush of tenth sternite bushy. . . . . 2. restuans
- Inner mesosomal plates with apexes forming a pair of round serrate lobes; the entire structure forms a sclerotized oval; brush of tenth sternite comblike, fig. 88. . . . . 1. apicalis

### Subgenus *Neoculex* Dyar

This subgenus is characterized by the apical abdominal bands on the abdomen. The male genitalia have the basistyles elongate, and the middle and inner mesosomal plates are represented by a single structure, fig. 88.

#### 1. *Culex apicalis* Adams

**LARVA.**—Fig. 80. Head broad and short, antennae long, with long apical setae and a large tuft situated close to the apex. Upper and lower head hairs single and very long. Eighth segment with a triangular comb of about 50 scales. Air tube long and slender, at least 10 times as long as width near the middle of pecten; pecten composed of 10 or more weak scales, beyond which are six or seven ventral tufts.

**FEMALE.**—Length of wing 2.5 mm. Head and thorax almost entirely light brown. Abdomen dark bluish brown with, usually, a narrow band of white scales along the apical margin of each segment; these bands may be interrupted in the middle of the segments, or completely absent on the basal four or five segments, but are always dis-

tinct on the sixth. Legs with tibiae and tarsi entirely bluish brown, femora chiefly cream color with dark scaling on the upper surface. Wings entirely bluish-brown scaled.

**MALE.**—Similar to female. Palps long and with an extensive apical brush. Male genitalia as in fig. 88. Basistyle slender, with a distinct subapical lobe bearing a pair of long sinuate narrow processes and a pair of shorter spurs. Tenth sternite with an apical row of truncate comblike setae. Middle and inner mesosomal plates apparently fused to form a heavily sclerotized oval structure beyond which project serrate edges of the ends of the middle plates.

Of the Illinois species of *Culex*, this is the earliest. The larvae are to be found soon after the early spring *Aedes* emerge; in southern Illinois in the latter part of April, in northern Illinois in early June. Apparently a cold water form, the species practically disappears during the hot summer weeks but reappears during the cooler weeks of late summer and early autumn. The larvae show a decided preference for open marshes or moderately shaded pools with clear water. The species is found throughout Illinois and has a wide distribution over most of North America. It is seldom noxious to man.

**Illinois Records.**—Larvae, collected April 17 to October 17, and adults, collected April 28 to October 6, are from Albion, Algonquin, Alma, Belleville (USPHS), Cache, Cairo (USPHS), Calvin, Camp Ellis (USPHS), Camp Grant (USPHS), Carbondale, Carterville (USPHS), Central City, Chanute Field (USPHS), Clinton, Cottage Grove, Crab Orchard Lake (USPHS), Dixon Springs, Downs, Dupo, Durand, East St. Louis, East Dubuque, Edwardsville, Effingham, Eichorn, Elsah, Epworth, Giant City State Park, Gorham, Gossett, Grafton (USPHS), Grand Tower, Granite City (USPHS), Grantsburg, Great Lakes Naval Training Station, Halfday, Herod, Herrin, Joetta, Johnston City (USPHS), Kappa, Karnak, Keithsburg, Lake Villa, Lake Zurich, La Rue, Lawrenceville (USPHS), Marion, Michael, Mill Shoals, Morris, Mount Carmel, Mount Vernon (USPHS), Mulberry Grove, Muncie, New Boston, New Haven, Oakwood, Olney, Omaha, Palos Park, Pere Marquette State Park, Princeton, Raymond, Rockville, Rockwood, Rosecrans, St. Jacob, St. Joseph, Savanna, Scott Field (USPHS), Seneca (USPHS), Shawneetown, Springfield, Starved Rock State Park, Sugar Grove, Thomson, Urbana, Utica, Vienna, Volo, Wadsworth, Waltersburg, Ware, Wauconda, West Vienna, White Heath, Willow Springs, Yellow Springs, and Zion.



Subgenus *Culex* Linnaeus

In this subgenus the scales on vein  $R_2$  and  $R_3$  are slender and elongate, similar to the scales on the stem of  $R_2$  and  $R_{2+3}$ , fig. 87*A*. In the males, the genitalia usually have the basistyle elongate and the middle and inner mesosomal plates differentiated as two pairs of processes.

2. *Culex restuans* Theobald

LARVA.—Fig. 79. Head moderately long. Antennae shorter than head, each antenna having short apical spines and a short tuft situated near middle. Preantennal tuft short and multiple. Upper and lower head hairs multiple and long. Eighth segment with triangular comb of about 30 or 40 scales. Air tube elongate, nearly five times as long as greatest width, slightly enlarged near middle and tapering to apex; pecten composed of 10 or more weak scales, beyond which there are two long setae and a short tuft on each side.

FEMALE.—Length of wing 4 mm. Head and mesonotum bright brown. Mesonotum usually having an indistinct band of cream scales around anterior and lateral portions and around scutellum; usually with a pair of spots of cream color about the middle of the sclerite. Dorsum of abdomen bluish brown, each segment with a basal bright cream band which has a nearly straight posterior margin. Legs with tibiae and tarsi entirely dark, femora cream, frequently with upper and outer areas dark. Wings entirely dark scaled.

MALE.—Similar in size, structure, and general color to female. Palps elongate, with an extensive apical brush. Male genitalia, fig. 91, similar in shape of basistyle, subapical lobe, and dististyle to those of *pipiens*, fig. 89*A*. Tenth sternite with a dense brush of narrow setae and with a moderately developed basal arm. Middle and inner mesosomal plates apparently fused, each side with a broad base, with one or two lateral bumps, and with a long apical process curved sharply laterad at tip.

In Illinois this species is one of the most common mosquitoes in unstocked fish ponds, rain barrels, semidomestic water holes, and pools of many types, especially those with abundant humus. It is distributed over the entire state. It occurs nearly as early in the season as *apicalis* and continues breeding

throughout the summer and into early autumn. Although it has been recorded as a painful biter, some observers believe that it bites little. Judged from our own experience, this species is seldom annoying; certainly it is not such a persistent and vicious biter as *erraticus*. Widespread throughout the eastern and central states from the Atlantic seaboard to the Rocky Mountains, *restuans* extends southward to the Gulf.

Illinois Records.—Larvae, collected April 17 to October 14, and many males and females, collected April 19 to November 23, are from Algonquin, Alton, Anna, Aurora, Belleville (USPHS), Cahokia (USPHS), Cairo (USPHS), Calvin, Camp Ellis (USPHS), Camp Grant (USPHS), Carbondale (USPHS), Carmi, Carterville (USPHS), Chanute Field (USPHS), Charleston, Chester, Clinton, Cottage Grove, Crah Orchard Lake (USPHS), Danville (USPHS), Durand, East Peoria (USPHS), East St. Louis, Elk Grove, Epworth, Forest City, Forest Glen, Fox Lake, Galesburg (USPHS), George Field (USPHS), Gorham, Grafton (USPHS), Grand Tower, Granite City (USPHS), Great Lakes Naval Training Station, Halfday, Havana, Herrin (USPHS), Hoopeston (USPHS), Johnston City (USPHS), Kappa, Karnak, Keithsburg, Lake Villa, La Rue, Lawrenceville (USPHS), Marion (USPHS), Maroa, Milford (USPHS), Mount Vernon (USPHS), Mount Zion, Muncie, New Haven, Oakwood, Olney, Orland Park, Palos Park, Pere Marquette State Park, Pittsburg, Pittsfield, Princeton, Ravinia, Reynoldsville, Ridge Lake, Rising Sun, Riverside, Rockford, Rock Island (USPHS), Roxana, Russellville, Salem, Savanna (USPHS), Scott Field (USPHS), Seneca (USPHS), Shawneetown, Skokie, Springfield (USPHS), Starved Rock State Park, Summerdale, Urbana, Vienna, Wadsworth, Waltersburg, Ware, Waterloo, White Heath, Willow Springs, Winnetka, Wolf Lake, and Zion.

3. *Culex pipiens* Linnaeus

LARVA.—Fig. 82. Head moderately wide, with fairly long apical bristles and a thick tuft situated near apex. Upper and lower head hairs multiple, as long as, or slightly longer than, the preantennal tuft. Eighth segment with triangular comb composed of 30 or 40 small scales. Air tube nearly four and one-half times as long as its width at end of pecten; pecten composed of about 10 weak scales; between the end of the pecten and apex of tube are four tufts on each side, one of them considerably more dorsad than the others; these tufts are long and usually composed of three hairs.

**FEMALE.**—Length of wing 3.5 mm. Head dark bluish brown with scattered gray scales on dorsum. Mesonotum entirely brown. Dorsum of abdomen bluish brown, each segment with a basal band of white scales; these bands moderately narrow, usually extending the full width of the segment and having the posterior margin irregular or nearly straight across; the bands on segments 3–6 should be used as examples. Legs with tibiae and tarsi black or dark, femora cream with dorsal or outer portions dark.

**MALE.**—Size, color, and general structure as for female. Palps elongate, with an extensive apical brush. Male genitalia, fig. 89: basistyle slender, its subapical lobe prominent, with a short leaflet and several bristles and spines; dististyle slender and curved. Tenth sternite with an apical brush of fairly short pointed spines, its basal arm slender and short, sometimes poorly developed and inconspicuous. Middle mesosomal plate with two lobes, an irregular sclerotized basal lobe, *a*, and a sickle-shaped apical lobe that has a sclerotized apical edge and a membranous area below this. Inner mesosomal plate composed of a single straight blunt blade on each side, the two forming a V-shaped structure.

Known as the northern house mosquito, this species is common over all of Illinois. The larvae frequent practically all types of domestic and semidomestic pools, such as rain barrels, tar buckets, fish ponds, clogged drains, and containers of various descriptions. The adults are persistent but wary biters, especially annoying at night in gardens or houses. The species occurs throughout the season, from late spring until early autumn. In garden pools it frequently occurs in company with *restuans* and *quinquefasciatus*. It is one of the easier species to control by the use of clean-up measures directed against the semidomestic type of water containers in which this species breeds.

The northern house mosquito is widely distributed over most of the temperate regions of the world having at least moderate rainfall. In the eastern states it extends south of Illinois into the northern portion of the southern states.

**Illinois Records.**—Larvae, collected from May 3 to September 15, and many males and females, collected from May 6 to November 15, are from Algonquin, Belleville (USPHS), Cahokia (USPHS), Cairo (USPHS), Camp Ellis (USPHS), Carbondale (USPHS), Carmi, Carter-

ville (USPHS), Central City, Chanute Field (USPHS), Charleston, Chicago, Clinton, Cottage Grove, Crab Orchard Lake (USPHS), Danville (USPHS), Decatur (USPHS), Dwight, East St. Louis, Edwardsville, Elsah, Forest Glen, Galesburg (USPHS), George Field (USPHS), Gibson City (USPHS), Grafton (USPHS), Granite City (USPHS), Great Lakes Naval Training Station, Havana, Herrin, Hoopston (USPHS), Johnston City (USPHS), Lawrenceville (USPHS), Marion, Metropolis, Mound City, Mounds, Mount Carmel, Mount Vernon (USPHS), Palos Park, Peoria (USPHS), Ravinia, Raymond, Rockford (USPHS), Rock Island (USPHS), St. Jacob, St. Joseph, Savanna (USPHS), Scott Field (USPHS), Seneca (USPHS), Springfield (USPHS), Urbana, Vienna, Ware, Willow Springs, and Zion.

#### 4. *Culex quinquefasciatus* Say

**LARVA.**—Fig. 83. Very similar in size, shape, and general structure to larva of *pipiens*. There is often considerable difficulty in separating specimens of the two species. Material of *quinquefasciatus* collected in Illinois is distinguished by the following combination of characters: air tube only about three and one-half times as long as its width at end of pecten; tufts on air tube usually with four or more branches and usually markedly shorter than greatest width of air tube. The gills of both species vary in length.

**ADULTS.**—Similar in almost all respects to *pipiens* adults. The female usually has definite-shaped basal bands on the abdominal tergites; in *quinquefasciatus* the bands are deeper than in *pipiens* and taper off completely at the edge of the dorsal aspect. Female specimens are encountered, however, in which it is difficult to distinguish between the two species either on this character or any other. The male genitalia are very similar to those of *pipiens* in general conformation. Those of *quinquefasciatus* are distinguished as follows, fig. 90: the distal lobe, *b*, of the middle mesosomal plates is larger and extends farther laterad than in *pipiens*; and the arms of the inner mesosomal plates make a U-shaped structure with converging arms (diverging arms in *pipiens*).

*Culex quinquefasciatus*, the southern house mosquito, occurs regularly in the southern third of the state but has been taken only sporadically northward. Light trap collections indicate that this species does not appear in numbers until July or August and usually disappears soon after the first

cool weather in September. The larvae frequent the same types of domestic and semidomestic containers as those of *pipiens* and the two species are usually represented in mixed cultures in Illinois. *C. quinquefasciatus* is distributed throughout most of the tropical and subtropical regions of the world. The Illinois records appear to be on the extreme northern edge of its North American range, which extends southward to the Gulf of Mexico.

In much of the literature, this species has been recorded under the name *fatigans* Wiedemann. Edwards (1932) prefers to refer *quinquefasciatus* Say to the list of dubiously known names. Since *quinquefasciatus* has been used consistently as at present, there seems no valid reason for discarding this name in favor of *fatigans*; *quinquefasciatus* was described in 1823, *fatigans* in 1828.

**Illinois Records.**—Larvae, collected from September 15 to October 1, and adults, collected from June 17 to November 23, are from Belleville (USPHS), Cahokia (USPHS), Cairo (USPHS), Carterville (USPHS), East St. Louis, Edwardsville, Grafton (USPHS), Granite City (USPHS), Herrin (USPHS), Johnston City (USPHS), Marion (USPHS), Mount Vernon (USPHS), Scott Field (USPHS), and Urbana.

### 5. *Culex salinarius* Coquillett

**LARVA.**—Fig. 84. Head moderately wide, antennae of moderate length, with long apical bristles and a stout tuft near apex. Upper and lower head hairs long, with at least four branches. Eighth segment with a triangular comb of about 50 small scales. Air tube very long and slender, about eight times as long as greatest width, pecten composed of about 10 weak scales and with several pairs of tufts irregularly placed between end of pecten and apex of tube.

**FEMALE.**—Length of wing 4 mm. Head and mesonotum bright brown, dorsum of abdomen bluish brown with narrow basal bands yellowish scaled on each segment, the bands frequently indistinct on the basal two or three segments and frequently broken up with brownish scales, giving them a muddy appearance. Legs with tibiae and tarsi entirely dark, femora mostly yellowish with upper and outer surfaces frequently dark. Wings entirely dark-brown scaled.

**MALE.**—Similar in size, color, and general structure to female. Palps long, having

extensive apical brushes. Genitalia, fig. 92: basistyle long and slender, its subapical lobe with a leaflet and several bristles and spines. Tenth sternite with a dense irregular apical brush and with a long stout basal arm. Middle mesosomal plates with a dorsal cluster of 8 or 10 stout teeth and a sharp upturned stout ventral arm. Inner mesosomal plates divergent, their apexes expanded and sinuate.

Although the species occurs generally throughout Illinois, individuals are present usually only in small numbers. Breeding commences fairly early in the season and continues at a fairly uniform rate throughout the summer and into the autumn. The larvae have been taken in a variety of habitats including swampy edges of lakes, oxbow pools, marshes of various types, ponds and cattle tracks, cattail bogs, stump holes, and polluted ditches. The females are said to bite readily, but in Illinois they are not sufficiently abundant to be a nuisance.

The species breeds in the eastern United States westward into the Rocky Mountains, and south to Florida and Texas.

**Illinois Records.**—Larvae, collected April 16 to October 15, and adults, collected May 5 to November 23, are from Alton, Belleville (USPHS), Cahokia (USPHS), Cairo (USPHS), Camp Ellis (USPHS), Camp Grant (USPHS), Carbondale (USPHS), Carmi, Carterville (USPHS), Chanute Field (USPHS), Cottage Grove, Dupon, East St. Louis, Edwardsville, Equality, Fox Ridge State Park, George Field (USPHS), Gorham, Grand Tower, Grafton (USPHS), Granite City (USPHS), Great Lakes Naval Training Station, Havana, Herrin, Jacksonville, Johnston City (USPHS), Karnak, Lake Glendale, La Ruz, Lawrenceville (USPHS), Marion, Maroa, Mount Vernon (USPHS), Muncie, Olney, Orland Park, Palos Park, Ridge Lake, Rock Island (USPHS), Roxana, St. Charles (USPHS), Savanna, Scott Field (USPHS), Seneca (USPHS), Springfield (USPHS), Urbana, Ware, Willow Springs, and Zion.

### 6. *Culex tarsalis* Coquillett

**LARVA.**—Fig. 81. Head moderately broad, proportioned much as in *pipiens*, fig. 82B. Antennae elongate, with long apical bristles and with a tuft near apex. Both upper and lower head hairs multiple and about as long as preantennal hair. Eighth segment with a triangular patch of about 50 small scales. Air tube slender, usually over six times as long as its width at end of pecten; pecten



composed of about 10 weak scales; beyond this are about five pairs of tufts arranged very irregularly but all near ventral margin; the basal three pairs are long and each one has three to six hairs, the apical two short and usually having two to four hairs.

**FEMALE.**—Length of wing 4.5 mm. Beak and palps dark brown, beak with a white band just beyond middle, palps with extreme apexes tipped with white scales. Dorsum of head with a mixture of brown and gray scales. Mesonotum brown with narrow grayish-white lines as illustrated in fig. 86*A*. Dorsum of abdomen brown with basal patches of white scales. Legs with posterior aspects of femora and tibiae cream, anterior aspects dark brown, each with a central stripe of white scales extending down the middle of this brown area from base to apex, the white line on the anterior legs broken into a series of white bars; tarsi dark bluish brown, all segments of hind tarsi with a white ring at both base and apex of segment, tarsi of front and middle legs with white bands indistinct on, or absent from, the apical two or three segments. Wings dark scaled except for a scattering of white scales on the costal region of each.

**MALE.**—In size, color, and general structure similar to female. Palps longer than beak, apical two segments with a long brush. Genitalia, fig. 93: basistyle elongate, with a pronounced subapical lobe bearing a small leaflet, a pair of stout spurs and a pair of more slender spines. Dististyle curved and narrow. Tenth sternite with a large apical lobe, the lateral series of teeth truncate and flattened. Middle mesosomal plates with three distinct processes: (1) a large blunt basal tooth, (2) a series of five or six long large sharp teeth, and (3) a curved ventral blade that is closely appressed to the inner mesosomal plate. This last forms a long curved slender blade.

In the plains states this species occurs in very large numbers; in Illinois it has been taken in widely scattered localities over the entire state and only rarely in large numbers. The adults occur chiefly in middle and late summer, with a few persisting into early autumn. The larvae have been found in a wide variety of situations, including hoof prints, pools, stream beds, marshes, and backwaters. A colony at Cahokia, Illinois, occurred in a drainage backwater having a very high pollution by sulfuric acid waste.

The species is said to hibernate as fertilized adult females; the males apparently die at the advent of winter. Breeding begins in early spring and continues until autumn.

The range of the species includes most of the semiarid regions of the west coast and the great plains. Illinois seems to be near the eastern edge of the range. Adults of this species have been found naturally infected with the virus of western encephalomyelitis. The females, which attack men readily, are on the wing chiefly at dusk or after dark. They invade houses often and are fierce and painful biters.

**Illinois Records.**—Larvae, collected June 11 to October 15, and males and females, collected June 21 to October 28, are from Algonquin, Belleville (USPHS), Cahokia (USPHS), Camp Ellis (USPHS), Carterville (USPHS), Chanut Field (USPHS), Des Plaines, East Peoria (USPHS), East St. Louis, Edwardsville, Fox Lake, Granite City (USPHS), George Field (USPHS), Great Lakes Naval Training Station, Greenville, Havana, Hoopeston (USPHS), Johnston City (USPHS), Marion (USPHS), Milford (USPHS), Savanna (USPHS), Scott Field (USPHS), Seneca (USPHS), Springfield, Urbana, Waterloo, and Zion.

#### Subgenus *Melanoconion* Theobald

This subgenus is characterized by the wide scales on veins  $R_2$  and  $R_3$ , which are in marked contrast with the long slender scales on  $R_s$ , fig. 87*B*. In the Illinois species, the males have the basistyle almost globular, and the middle and inner mesosomal plates not differentiated from each other.

#### 7. *Culex erraticus* (Dyar & Knab)

**LARVA.**—Fig. 85. Head moderately wide. Antennae long, with long apical bristles and with a long tuft situated near apex, preantennal tuft long and dense, lower head hairs long, single, and bristle-like. Upper head hairs very short and multiple, with at least four and usually six hairs to each bristle. Abdomen with most of the segments spiculate, having a covering of extremely fine spinules giving it a dense, pilose appearance. Eighth segment with comb consisting of an irregular single or double row of 12 to 15 scales. Air tube only moderately long but narrow, about six times as long as its width at end of pecten; pecten composed of about 12 weak scales; beyond this are four or five



pairs of long multiple tufts situated very close to ventral margin.

**FEMALE.**—Length of wing 3.5 mm. Head, mesonotum, and dorsum of abdomen almost entirely purplish-brown scaled; abdomen usually with narrow basal bands of cream scales, usually with brown scales intermingled so that the bands are indistinct and muddy. Dorsum of head having a wide triangular mesal area with narrow scales, the area between this and the eye covered with broad overlapping scales; these are in addition to the erect scales that stand up like a comb above this area. Legs dark except for usually creamy portions of femora. Wings entirely dark scaled.

**MALE.**—Size, color, and general structure as for female. Palps long, with extensive apical brushes. Male genitalia, fig. 95: basistyle short and almost globular; apical lobe produced into three long stout stalks, the two lower ones each bearing a stout flattened process, the upper one bearing a leaflet and three spines; dististyle sinuate, with the end ridged and produced into a pair of minute teeth. Tenth tergite bearing a row of flattened teeth and a stout basal lobe of moderate length. Middle mesosomal plates bladellike and each divided at apex into a short sharp mesal point and a wider blunt lateral triangle. Inner mesosomal plates apparently not differentiated.

Abundant and widespread in southern and central Illinois, this species is a comparative rarity in the northern part of the state. The larvae frequent marshy areas at the edges of lakes, pools, and ponds in which there is abundant emergent vegetation. They are especially numerous in ponds with growth of cattails and water primrose. In addition to ponds, they frequent vegetation-choked shallows along the edges of sluggish streams and ditches. They are usually taken in company with *Anopheles*, and frequently with *Uranotaenia*, also. In Illinois, adult emergence begins in the southern part of the state, usually early in June, and continues until early autumn. The adults attack with persistence and inflict painful bites.

The species is widespread throughout the southern states. Illinois is near the northern edge of its range. It was recorded from Illinois by Matheson (1930) under the name *inhibitor* Dyar & Knab. At that time *erraticus* was generally considered a direct synonym of *inhibitor*. King & Bradley (1937) have shown, however, that *inhibita-*

*tor* and *erraticus* are distinct species. The name *inhibitor* should be applied to a Santo Domingan species, whereas *erraticus* is the name to be used for this small dark Illinois mosquito.

**Illinois Records.**—Larvae, collected from June 29 to October 3, and males and females, collected from June 2 to November 4, are from Alma, Belleville (USPHS), Benton, Cahokia (USPHS), Cairo, Carbondale, Carterville (USPHS), Charleston, Cottage Grove, Coulterville, Crab Orchard Lake (USPHS), Decatur (USPHS), East Hannibal, East Peoria (USPHS), East St. Louis, Edgemoor, Edwardsville, Effingham, Elsah, Fox Ridge State Park, George Field (USPHS), Gibsonia, Gossett, Grafton (USPHS), Grand Tower, Granite City (USPHS), Grayville, Greenville, Hannibal, Havana, Herod, Herrin, Hull, Johnston City (USPHS), Karbers Ridge, Lake Glendale, Marion, Maroa, Momence, Mount Vernon, Neoga, Oakwood, Olive Branch, Omaha, Peoria (USPHS), Pete Marquette State Park, Pike, Ridge Lake, Rock Island (USPHS), St. Joseph, Salem, Seneca (USPHS), Springfield (USPHS), Ware, West Vienna, and Willow Springs.

### 8. *Culex peccator* Dyar & Knab

**LARVA.**—Very similar to larva of *erraticus*, differing as follows: upper head hairs short as in *erraticus* but only double or triple; body only sparsely spiracular; comb with the scales forming a definite patch rather than an irregular line.

**ADULTS.**—Similar in size, color, and general structure to those of *erraticus*. Both sexes differ in having almost the entire occiput covered with appressed and overlapping scales, at the most with a narrow mesal line of narrow scales. Males differ in characters of the genitalia, fig. 94: the basistyle is nearly globular, as in *erraticus*, the subapical lobe is very definite, the leaflet large, irregular, and expanded, the stalks thicker and definitely proportioned; dististyle very thick, sharply bent at nearly a right angle with a series of concavities and brushlike lines of minute setae.

Like the preceding, this species occurs throughout the southeastern states, where it is usually a rarity. In Illinois, we have taken only a few records of the species and most of these are in the southern fifth of the state. The larvae presumably frequent woodland pools with emergent vegetation. King, Bradley, & McNeel (1939) note that the larvae, when found, are almost always associated with those of *apicalis*.

Illinois Records.—CARBONDALE: June 22–23, 1942, 1 ♂, 2 ♀; October 19, 1943, 1 ♂. CARTER-VILLE: Aug. 13, 1942, 1 ♂. GOSSETT: June 3, 1942, Ross & Mohr, 3 larvae. GRANTSBURG: June 10, 1941, Ross & Mohr, 1 larva. LA RUE: Oct. 1, 1942, 1 ♂. OLNEY: June 10, 1941, Ross & Mohr, 1 larva. SCOTT FIELD: Sept. 10, 1942, light trap, 1 ♂.

### 9. *Aedes* Meigen

To this genus belong nearly half of the Illinois mosquito fauna, with records for 21 species, which include nearly all of the truly nuisance species and both early spring and temporary summer pool species. One or two of the species transmit mammalian diseases.

In all species of the genus, as far as known, the eggs are laid on moist soil or humus, or just above the water line in tree holes or artificial containers. They hatch only after they have been flooded. Some species, in which a desiccation and cold period is necessary for hatching, have only a single generation per year, the adults emerging in early spring. Other species are intermittent breeders and usually have two or three generations per year, depending on the rains.

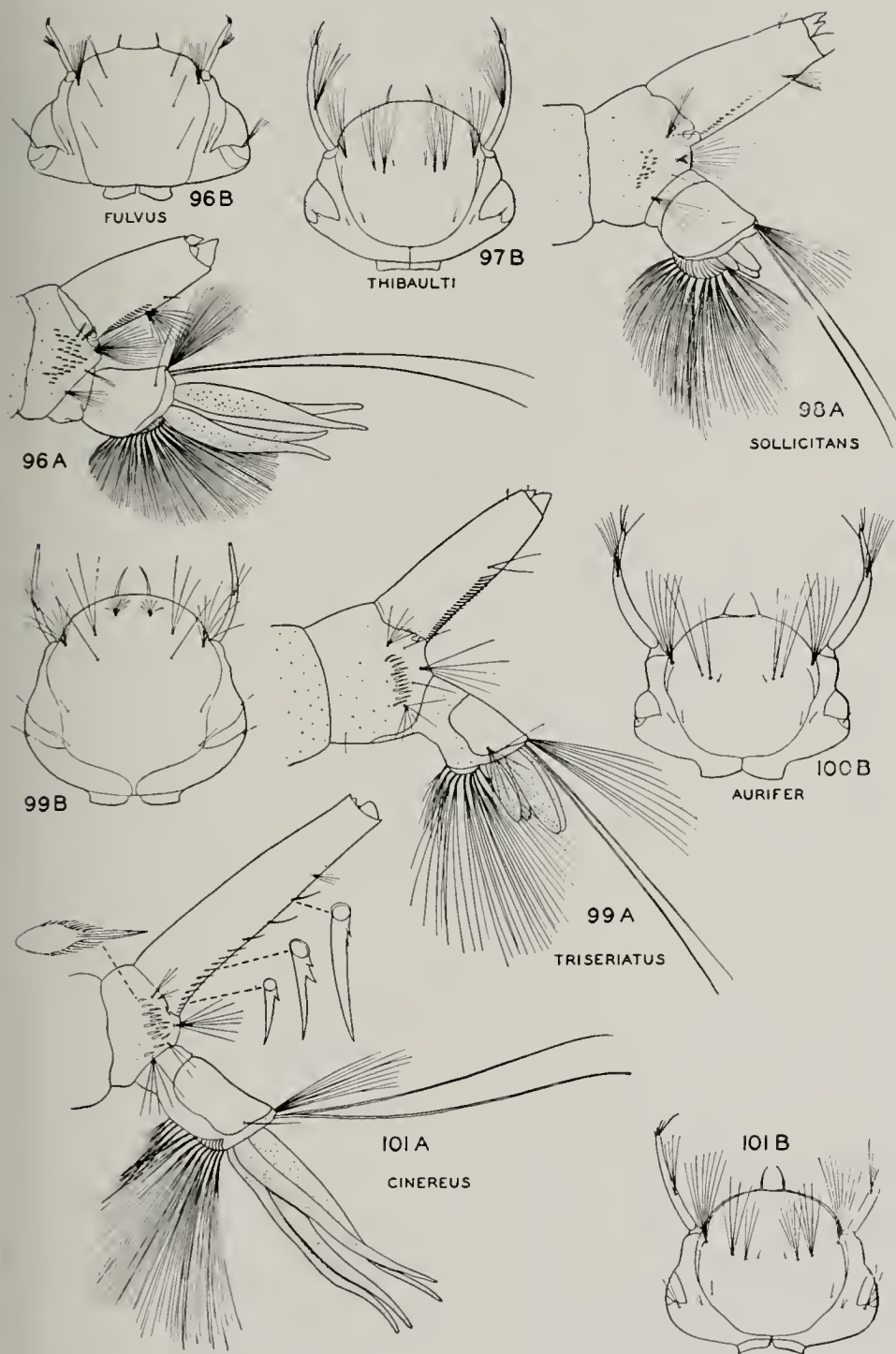
Certain taxonomic difficulties were encountered in studying the genus. The most important resulted in the discovery that in many of the species the head hairs of the larvae were extremely variable, with the result that often in the then existing keys each side of the head of a single individual would key out to a different species. Frequently, on this same basis, specimens of a pure culture would key out to several species. With the Illinois species it was possible to circumvent this difficulty by introducing new key characters especially concerning the relative positions of various stable hairs.

Supplemental material regarding extralimital species may be found in all of the comprehensive treatments of the family listed under the heading "Literature" on page 15.

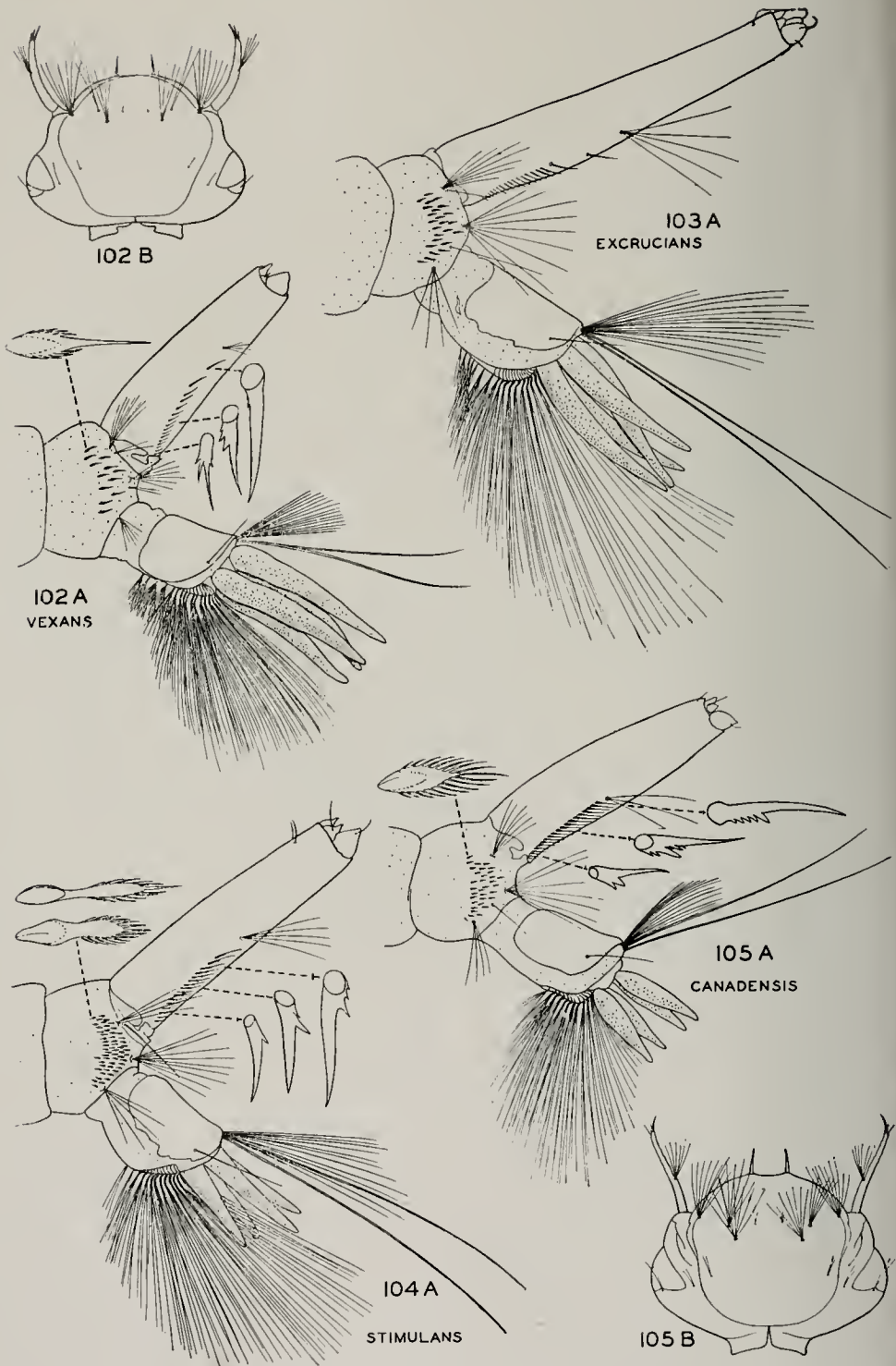
#### KEY TO SPECIES

##### LARVAE

1. Anal segment completely ringed by sclerotized plate, fig. 96.....2
- Anal segment with sclerotized plate not meeting on venter, frequently forming only a dorsal saddle, fig. 99.....9
2. Pecten extending beyond ventral tuft, fig. 96.....21. *fulvus pallens*
- Ventral tuft situated beyond end of pecten, fig. 98.....3
3. Gills budlike, much shorter than anal segment, fig. 98.....4. *sollicitans*
- Gills at least as long as anal segment, fig. 99, frequently very long and pointed at tip, fig. 101.....4
4. Gills extremely long, two or three times length of air tube, and with prominent tracheae, fig. 111; pecten with only a few scales.....20. *dupreei*
- Gills shorter than air tube, without tracheae, fig. 106; pecten with about 15 scales.....5
5. Air tube short, not more than two and one-half times as long as wide, and pecten with several widely detached teeth.....5. *nigromaculis*
- Either air tube over three times as long as wide, or pecten without detached teeth.....6
6. Comb consisting of about 12 scales or less forming a single row, fig. 106.....7
- Comb either consisting of 15 or more scales or forming a double row or triangular patch, fig. 108.....8
7. Comb with 6 evenly spaced teeth; apico-dorsal tuft of anal segment represented by a pair of long, strong setae, as in fig. 106.....22. *implacabilis*
- Comb with about 12 teeth forming an irregular line; apico-dorsal tuft of anal segment many haired, fanlike, fig. 107.....23. *punctor*
8. Air tube with ventral brush two-thirds distance from base to apex, fig. 108.....14. *trivittatus*
- Air tube with ventral brush midway between base and apex.....6. *mittchellae*
9. Head with preantennal hair delicate and single, fig. 112; anal segment with preapical dorsal tuft only three-branched, but as long as apical tuft....2. *aegypti*
- Head with preantennal hair divided into a 4- to 15-branched tuft, fig. 113; anal segment with preapical dorsal tuft 8- to 15-branched, much shorter than apical tuft.....10
10. Pecten with one or more apical teeth spaced fairly wide apart, appearing detached from row, figs. 101–103....11
- Pecten with all teeth close together and forming an even row, figs. 104, 105....16
11. Head with lower head hair considerably laterad of, and only slightly anteriorad of, upper head hair, fig. 100.....12
- Head with lower head hair only slightly laterad of, but considerably anteriorad of, upper head hair, fig. 102.....13
12. Antennae fairly thick at base and long, tuft beyond middle, fig. 100; upper and lower head hairs double, occasionally

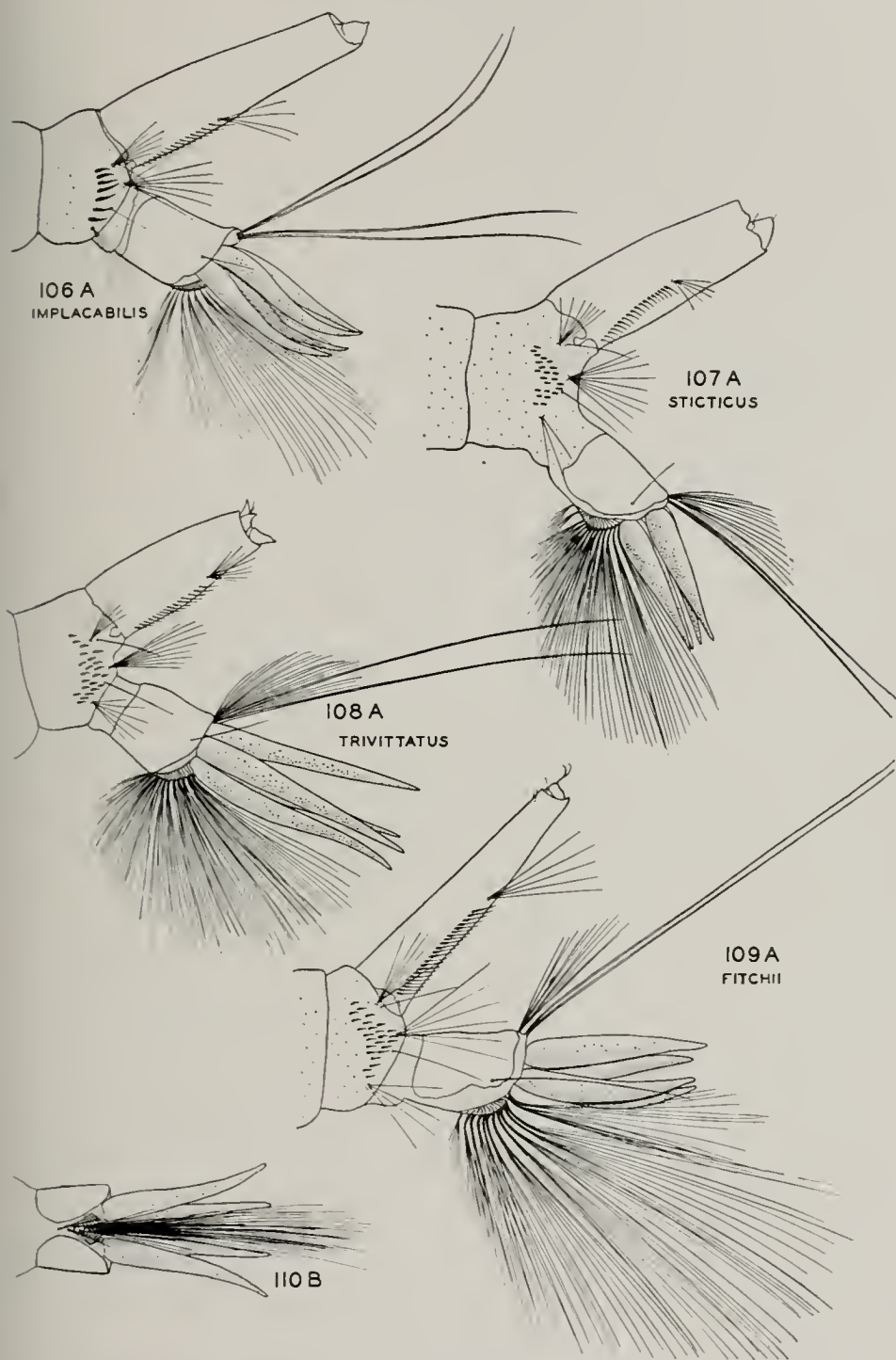


Figs. 96-101.—*Aedes* larvae; A, apex of abdomen, lateral aspect; B, dorsum of head. Inset are details of pecten and comb scales. On these and succeeding larval head drawings of *Aedes*, the mouth brushes are omitted.

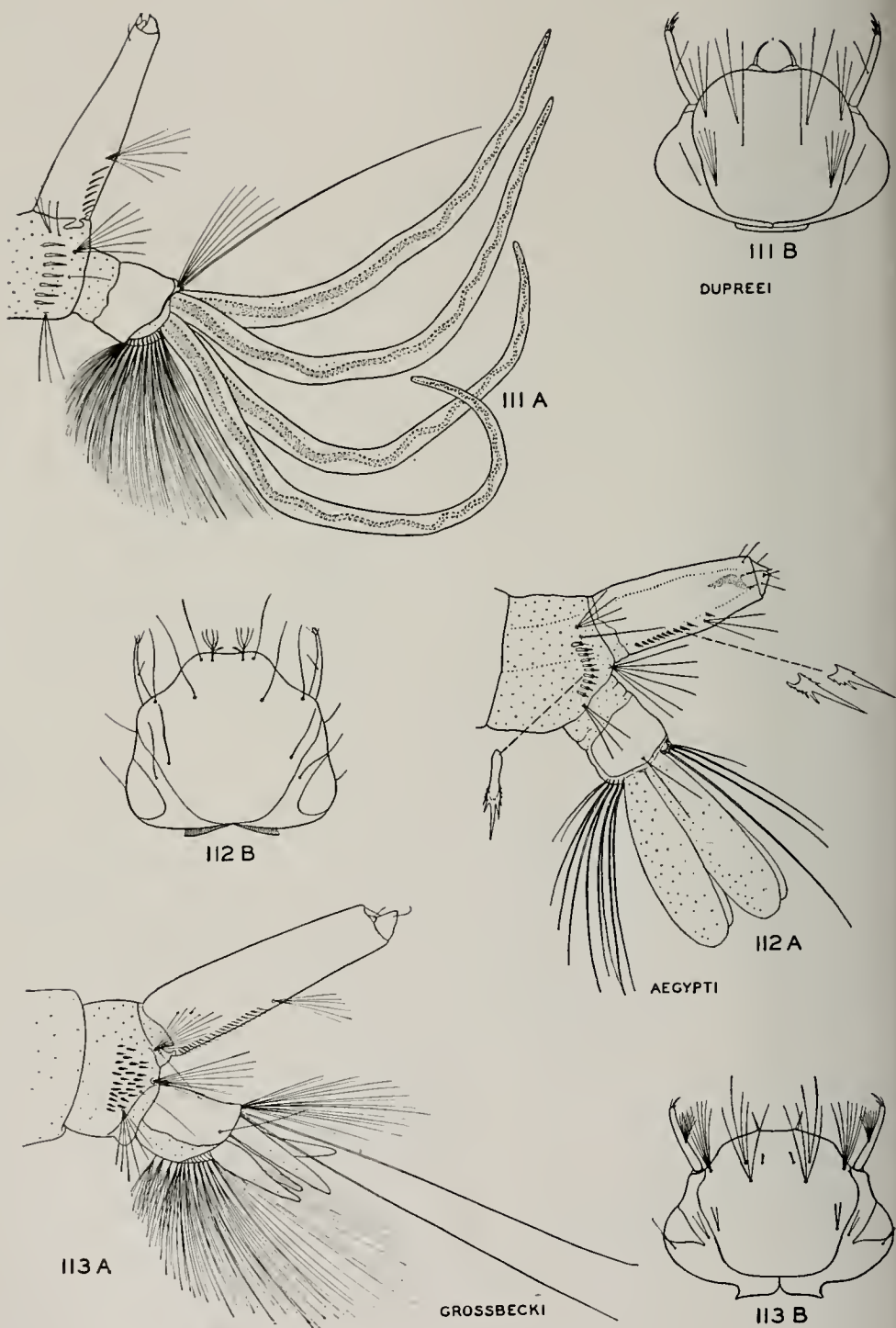


Figs. 102-105.—*Aedes* larvae; A, apex of abdomen, lateral aspect; B, dorsum of head. Inset are enlarged drawings of pecten and comb scales.





Figs. 106-110.—*Aedes* larvae, apex of abdomen. All are the lateral aspect except fig. 110B, which is the ventral aspect of *A. spencerii* showing one or two anal hair tufts anterior to the barred area at base of gills.



Figs. 111-113.—*Aedes* larvae; *A*, apex of abdomen, lateral aspect; *B*, dorsum of head. Inset are enlarged drawings of pecten and comb scales. (Fig. 111 redrawn from Dyar.)

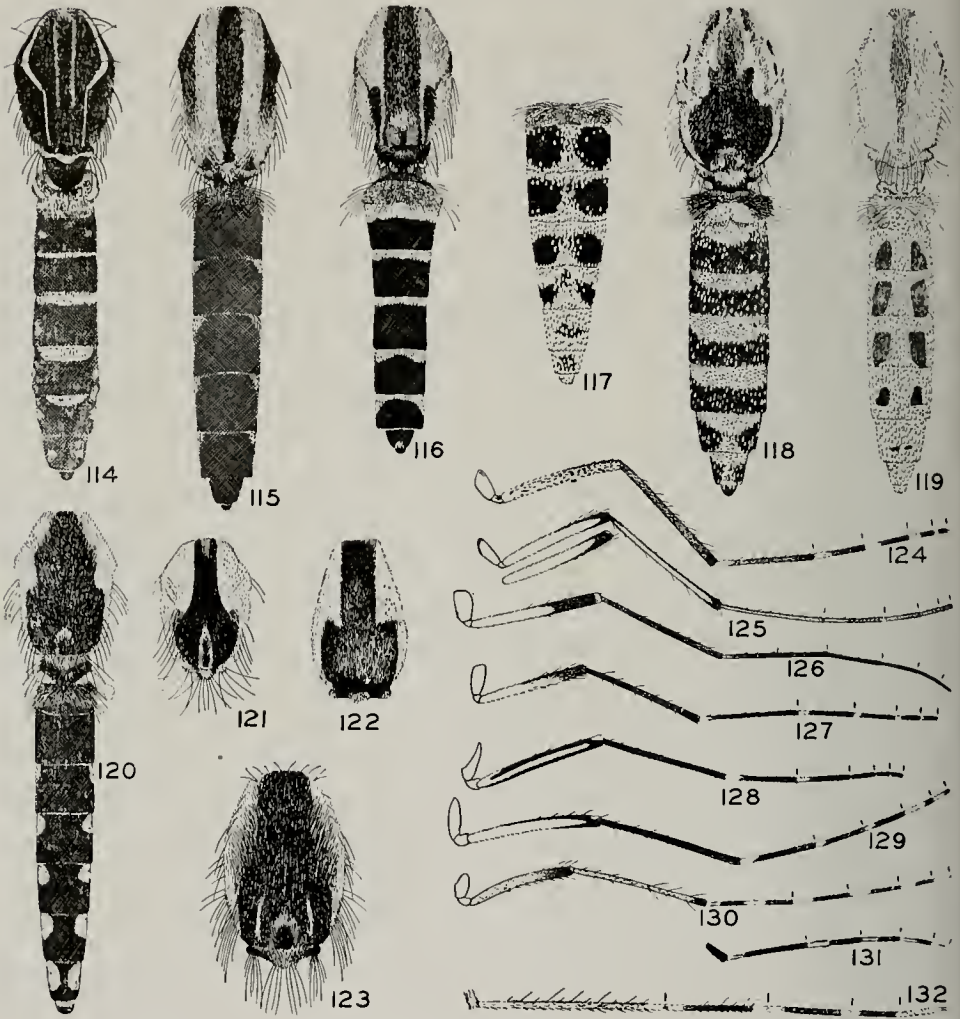
- one of the four triple; clypeal bristles moderately far apart. . . . .15. *aurifer*  
 Antennae not enlarged at base, tuft below middle, fig. 101; upper and lower head hairs triple to multiple, at least two of the four with four to six branches; clypeal bristles much closer together. . . . .7. *cinereus*
13. Air tube five times as long as width at middle of pecten, its ventral tuft very long, fig. 103. . . . .8. *excrucians*  
 Air tube not more than four times as long as width at middle of pecten, its ventral tuft frequently short, fig. 102. . . . .14
14. Upper and lower head hairs single; anal segment with only one or two tufts anterior to apico-ventral barred area, fig. 110. . . . .19. *spencerii*  
 Upper and lower head hairs double to quadruple; anal segment with several tufts anterior to barred area, fig. 102. . . . .15
15. Lateral comb consisting of more than 20 scales in a triangular patch. . . . .9. *flavescens*  
 Lateral comb consisting of 10 to 15 scales in an irregular single or double row, fig. 102. . . . .3. *vexans*
16. Gills budlike, much shorter than anal segment, as in fig. 98*A*. . . . .16. *dorsalis*  
 Gills long, either tapering at apex, fig. 104, or sausage shaped, fig. 99. . . . .17
17. Lateral comb of segment 8 forming a single row or an irregular double row of about 10 to 15 large well-spaced teeth, fig. 99. . . . .1. *triseriatus*  
 Lateral comb forming a somewhat triangular patch containing 20 or more teeth, figs. 104, 109. . . . .18
18. Both upper and lower head hairs with four or more branches, short, similar in length and appearance to preantennal hair; clypeal hairs only about half as far apart as upper head hairs, fig. 105. . . . .17. *canadensis*  
 Either upper or lower head hairs with only three branches or less, much longer than preantennal hair, or clypeal hairs about as far apart as upper head hairs, fig. 97. . . . .19
19. Lower head hairs situated considerably to the side of, and only slightly anterior to, upper head hairs, the upper hairs usually with five branches or more; antennae very long, three-quarters length of head, with antennal tuft very long, fig. 97. . . . .12. *thibaulti*  
 Lower head hairs almost directly anterior to, and only slightly laterad of, upper head hairs, the latter only rarely with as many as four or five branches; antennae shorter, with a shorter tuft, fig. 113. . . . .20
20. Air tube five times as long as width at middle of pecten, tapering markedly, so that apex is about half width of base, fig. 109*A*, its apical spine long and dark. . . . .11. *fitchii*  
 Air tube at most four times as long as width at middle of pecten, tapering less, so that apex is about three-quarters width at base, its apical spine short and inconspicuous, fig. 107. . . . .21
21. Sclerotic plate of anal segment only slightly longer than deep, extending more than three-quarters distance down sides of segment, fig. 107; air tube with ventral tuft only about half as long as tuft posterior to comb. . . . .18. *sticticus*  
 Sclerotic plate of anal segment much longer than deep, extending only one-half or two-thirds distance down sides of segment, fig. 104; air tube with ventral tuft about as long as tuft posterior to comb. . . . .22
22. Lower head hairs usually single; prothoracic hairs 4 and 7 single; ventral tuft of air tube usually with three or four hairs. . . . .10. *stimulans*  
 Lower head hairs usually double or triple; prothoracic hairs 4 and 7 usually double; ventral tuft of air tube usually with five to eight hairs. . . . .13. *grossbecki*

## FEMALES

1. Tarsi with white rings, figs. 127-132. . . . .2  
 Tarsi without white rings, figs. 125, 126. . . . .13
2. Tarsi with narrow rings at both ends of some segments, fig. 132. . . . .3  
 Tarsi each with a ring at only one end of a segment, fig. 130. . . . .4
3. Wing scales uniformly dark. . . . .17. *canadensis*  
 Wing scales mostly white with a small mixture of black scales. . . . .16. *dorsalis*
4. Proboscis dark with a definite white band, fig. 35. . . . .5  
 Proboscis nearly uniformly colored. . . . .7
5. All wing scales dark; hind basitarsus black with a single basal white band, fig. 131. . . . .6. *mitchellae*  
 Some wing scales black, some white, giving a spotted appearance; hind basitarsus frequently with a middle yellowish band in addition to basal white band, fig. 130. . . . .6
6. Abdomen with extensive dorsal areas of cream or tawny scales and small lateral areas of white scales, the two colors definitely contrasting. . . . .4. *solicitans*  
 Abdomen with both dorsal and lateral pale scales white. . . . .5. *nigromaculis*

7. Mesonotum black with lyre-shaped silver markings, fig. 114.....2. *aegypti*  
 Mesonotum otherwise, figs. 115-123, never  
 with extensive silver lines.....8

8. White tarsal rings narrow, fig. 127.....3. *vexans*  
 White tarsal rings wider, figs. 124, 130  
 .....9



Color Patterns of Female *Aedes*

Fig. 114.—*A. aegypti*, dorsum of thorax and abdomen.

Fig. 115.—*A. trivittatus*, dorsum of thorax and abdomen.

Fig. 116.—*A. sticticus*, dorsum of thorax and abdomen.

Fig. 117.—*A. spencerii*, dorsum of abdomen.

Fig. 118.—*A. grossbecki*, dorsum of thorax and abdomen.

Fig. 119.—*A. dorsalis*, dorsum of thorax and abdomen.

Fig. 120.—*A. triseriatus*, dorsum of thorax and abdomen. This figure illustrates dark phase of thoracic pattern.

Fig. 121.—*A. triseriatus*, dorsum of thorax of light phase.

Fig. 122.—*A. thibaulti*, dorsum of thorax. (After King, Bradley, & McNeel.)

Fig. 123.—*A. aurifer*, dorsum of thorax.

Fig. 124.—*A. grossbecki*, hind leg.

Fig. 125.—*A. sticticus*, hind leg.

Fig. 126.—*A. triseriatus*, hind leg.

Fig. 127.—*A. vexans*, hind leg.

Fig. 128.—*A. aegypti*, middle leg.

Fig. 129.—*A. aegypti*, hind leg.

Fig. 130.—*A. sollicitans*, hind leg.

Fig. 131.—*A. mitchellae*, hind tarsus.

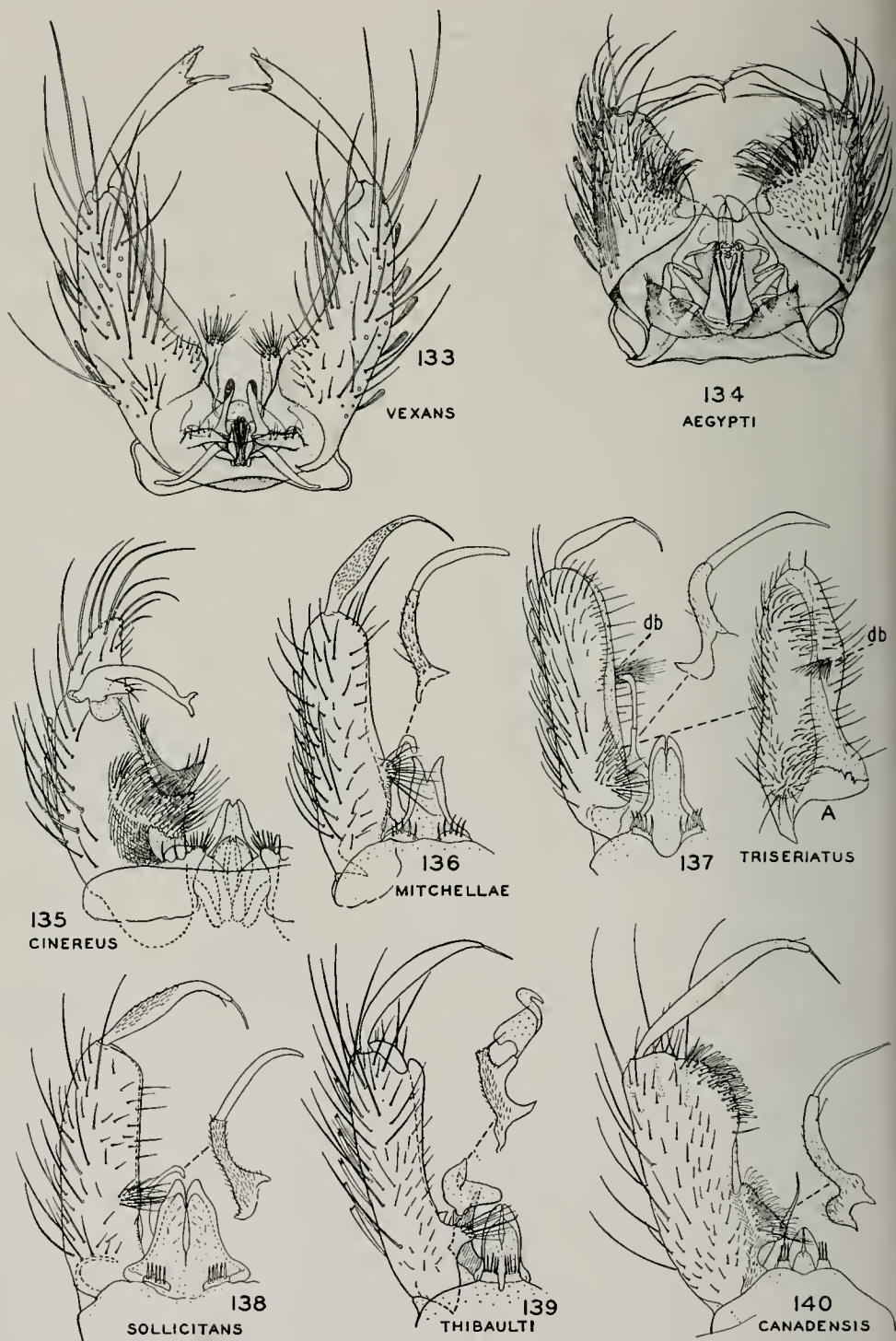
Fig. 132.—*A. dorsalis*, hind tibia and tarsus.



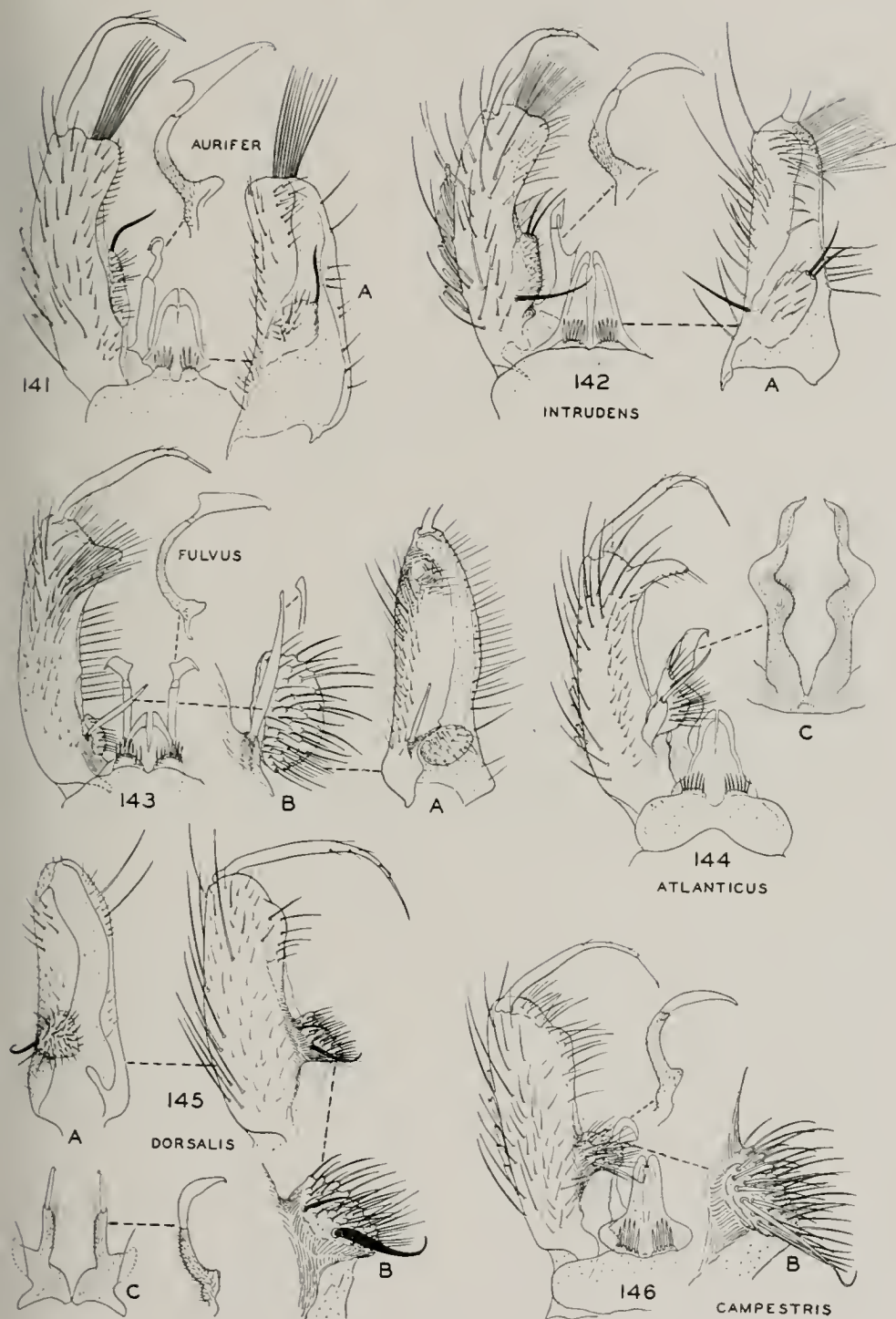
9. All veins of wings with rows of very wide scales, fig. 169; mesonotum as in fig. 118, with a large central black spot enlarged posteriorly ..... 13. *grossbecki*  
Some veins with rows of only long narrow scales, fig. 168; mesonotum marked otherwise ..... 10
10. Abdomen entirely covered with yellowish scales, without banding; mesonotum entirely yellowish ..... 9. *flavescens*  
Either abdomen with decided banding or mesonotum with a pattern of gray or reddish brown ..... 11
11. Lower part of mesepimeron with three to five fine long bristles; mesonotum frequently patterned with light gray brown, but occasionally reddish brown ..... 10. *stimulans*  
Lower part of mesepimeron with none to two fine long bristles; mesonotum always predominantly reddish brown ..... 12
12. Mesonotum with a fairly narrow reddish-brown stripe, flanked with white or cream; one or two lower mesepimeral bristles usually present ..... 11. *fitchii*  
Mesonotum with reddish-brown central area larger and not well defined; no lower mesepimeral bristles present ..... 8. *excrucians*
13. Mesonotum with a definite mesal silvery triangle, flanked with dark areas ..... 20. *dupreei*  
Mesonotum without a mesal silvery triangle, usually with a mesal dark area flanked with light areas, figs. 115, 121 ..... 14
14. Mesonotum with very dark or black mesal area flanked by gray or silvery areas, figs. 115, 121 ..... 15  
Mesonotum brown or yellow, often uniform in color, sometimes with mesal area reddish brown and lateral areas light golden brown ..... 20
15. Central stripe of mesonotum narrow, tapering posteriad, well defined, fig. 115 ..... 14. *trivittatus*  
Central stripe either wider posteriad, fig. 121, or parallel sided, fig. 116 ..... 16
16. Central stripe of mesonotum parallel sided, sometimes with a pair of detached short dark stripes along posterior half, fig. 116; abdominal tergites with complete basal or mesal white bands ..... 17  
Central stripe of mesonotum much narrower anteriad, usually widened posteriad to almost the full width of the mesonotum, figs. 121, 123, abdominal tergites mostly blue black, with lateral white spots on some segments, but without bands, fig. 120 ..... 18
17. Abdomen with light stripes narrow, regular and basal, widest on basal segment, fig. 116, without mesal or apical stripes ..... 18. *sticticus*  
Abdomen with light stripes basal, apical and mesal, narrowest on basal segments and almost covering the apical segments, fig. 117 ..... 19. *spencerii*
18. Scales of postero-lateral lobes of pronotum white and wide, markedly overlapped to form a solid shingled area, fig. 170, very similar to scales of mesopleurae ..... 1. *triseriatus*  
Scales of postero-lateral lobes of pronotum long and narrow, only half as wide as mesopleural scales, tawny or yellowish in color and not solidly shingled, fig. 171, markedly contrasting with scales of mesopleurae ..... 19
19. Mesal dark mark of mesonotum with anterior portion narrow, suddenly widened beyond middle to include nearly full width of mesonotum, fig. 122; antero-lateral areas bright grayish white ..... 12. *thibaulti*  
Mesal dark mark of mesonotum with anterior part wider, widening gradually to posterior margin, fig. 123; lateral areas grayish, shading to a golden tint where they merge with mesal dark area ..... 15. *aurifer*
20. Integument and scaling entirely bright golden yellow, except a few black-scaled areas ..... 21. *fulvus pallens*  
Integument dark brown to black, with few or no yellow scales ..... 21
21. Maxillary palps with apical segments only slightly longer than basal segments; wing at most 4.3 mm. long; abdomen with very narrow cream basal bands on dorsum but with all of ventral part of tergites cream ..... 7. *cinereus*  
Maxillary palps with apical segments twice as long as basal segments; wing over 4.8 mm. long; abdomen either with wide basal bands, or ventral part of tergites with considerable areas of dark scales ..... 22. *implacabilis*; 23. *punctor*

## MALES

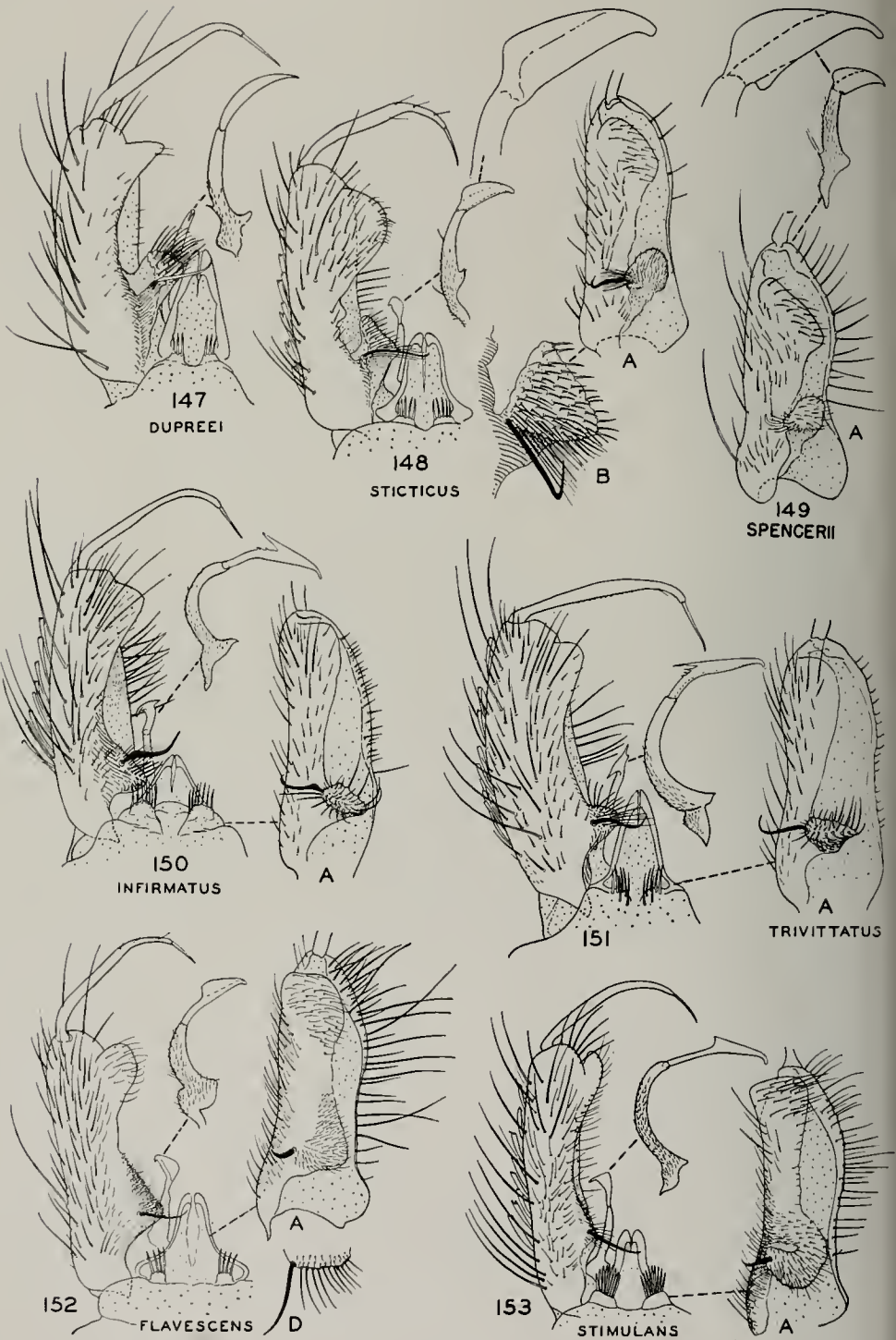
1. Dististyle inserted before apex of basistyle, the portion beyond the dististyle forming an apical cone, fig. 135 ..... 7. *cinereus*  
Dististyle articulating as extreme apex of basistyle, fig. 133 ..... 2
2. Dististyle wide near apex, terminating in a sharp projection that is nearly as long as terminal spine; claspettes forming a small, bushy lobe, fig. 133 ..... 3. *vexans*  
Dististyle narrow at apex, tipped by terminal spine, fig. 134 ..... 3
3. Claspettes absent, fig. 134 ..... 2. *aegypti*  
Claspettes present, figs. 136-158 ..... 4



Figs. 133-140.—*Aedes*, male genitalia, ventral aspect; A, mesal aspect of bastistyle; db, dorsal brush; inset is claspette, lateral aspect. (Figs. 133, 134 after Matheson.)

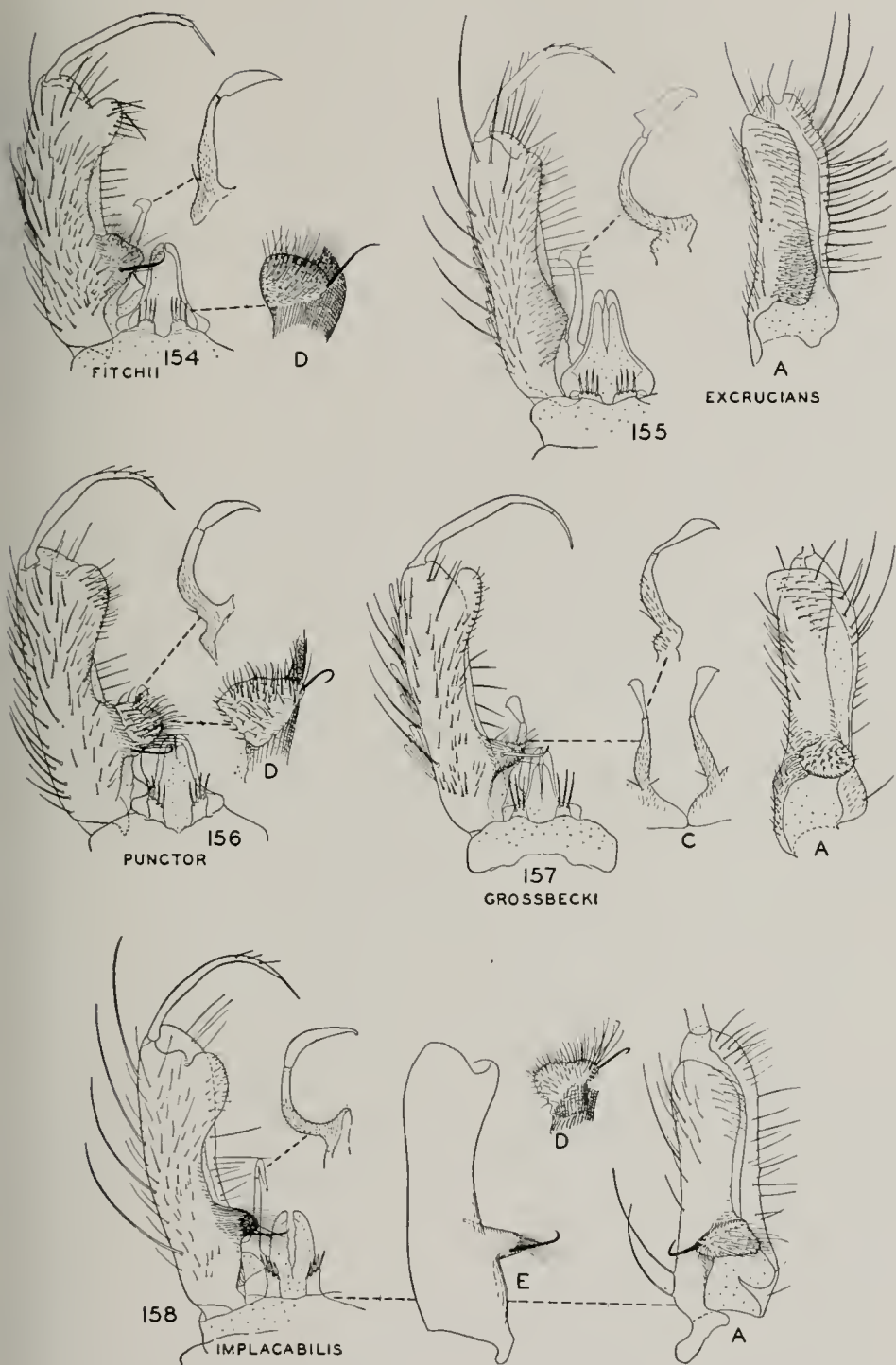


Figs. 141-146.—*Aedes* male genitalia, ventral aspect. *A*, basistyle, mesal aspect; *B*, enlarged detail of basal lobe, ventral aspect; *C*, claspettes, dorsal aspect; inset is claspette, lateral aspect.



Figs. 147-153.—*Aedes* male genitalia, ventral aspect. A, basistyle, mesal aspect; B, basal lobe, ventral aspect; D, basal lobe, posterior aspect; inset is claspette, lateral aspect and in figs. 148 and 149 a detail of its apex.





Figs. 154-158.—*Aedes* male genitalia, ventral aspect. *A*, basistyle, mesal aspect; *C*, claspette, dorsal aspect; *D*, basal lobe, posterior aspect; *E*, basistyle, ventro-lateral aspect silhouette; inset, claspette, lateral aspect.

4. Basistyle without apical lobe, figs. 136-138 .....5  
 Basistyle with apical lobe definitely developed, figs. 139, 140, or represented by a mass of long setae, figs. 141, 142. ....7
5. Basistyle with a thick brush of setae (*db*) on dorsal side, fig. 137; basal lobe with a large area of setae. ....1. *triseriatus*  
 Basistyle without a brush of setae on dorsal side, but with a definite brush forming the basal lobe, figs. 136, 138. ....6
6. Basal lobe a distinct, raised prominence; basistyle considerably widened at basal lobe, fig. 136. ....6. *mittellae*  
 Basal lobe represented by only a slightly raised disclike area; basistyle only imperceptibly widened at this point, fig. 138. ....5. *nigromaculis*; 4. *solicitans*
7. Apical process of claspette massive and contorted, fig. 139, the contorted portion thin and pale. ....12. *thibaulti*  
 Apical process of claspette forming a narrow blade, which may be straight, fig. 140, curved, fig. 143, or barbed, fig. 141 .....8
8. Basistyle with a dense patch of long setae at apex; basal lobe forming a flat sclerite on mesal face, with a single long dorsal spine, fig. 141. ....15. *aurifer*  
 Basistyle without a dense apical patch of long spines, but with a well-developed apical lobe; basal lobe otherwise, either projecting, or with a large ventral spine, or without a spine, sometimes with a cluster of long setae. ....9
9. Apical lobe with a large dense patch of spatulate setae, fig. 140. ....17. *canadensis*  
 Apical lobe with setae all narrow and hairlike, figs. 143-158. ....10
10. Apical lobe of basistyle very long, a distinct angulation near middle of basistyle, fig. 143; integument of almost entire body yellow. ....21. *fulvus pallens*  
 Apical lobe either short, fig. 144, or without an extra angulation, fig. 145; integument chiefly dark brown or black. ....11
11. Basal lobe with two macrochaetae and many small setae, those near the macrochaetae minute, fig. 145. ....16. *dorsalis*  
 Basal lobe at most with only one macrochaeta, sometimes with some of the other setae very long, fig. 147. ....12
12. Basal lobe triangular and appearing detached, joined to basistyle by only a narrow sclerotized strip, figs. 147-149. ....13  
 Basal lobe forming a solid part of the basistyle .....15
13. Apical lobe small, fig. 147, with a few projecting setae along its mesal margin .....20. *dupreei*  
 Apical lobe large, fig. 148, with numerous appressed setae along its mesal margin .....14
14. Appendage of claspette wide, its lower basal corner produced; mesal aspect of apical lobe long and narrow, fig. 149. ....19. *spencerii*  
 Appendage of claspette narrower, its lower margin almost confluent in outline with claspette; mesal aspect of apical lobe shorter, decidedly ovate, fig. 148 .....18. *sticticus*
15. Basal lobe without macrochaetae, having only abundant short setae, fig. 155. ....8. *excrucians*  
 Basal lobe with at least one conspicuous macrochaeta or a group of long setae, fig. 154. ....16
16. Head of claspette produced backward into a sharp basal barb, fig. 151. ....14. *trivittatus*  
 Head of claspette without a barb, fig. 152 .....17
17. Basal lobe composed primarily of an area of short setae forming the basal portion of the mesal face of the basistyle, figs. 152, 153 .....18  
 Basal lobe represented by a distinct lobe projecting mesad from the basistyle, figs. 154, 156. ....19
18. Area comprising basal lobe long and triangular, its basal spine very large, fig. 152; appendage of claspette fairly short .....9. *flavescens*  
 Area comprising basal lobe shorter, its lower portion somewhat projecting, its basal spine only moderately large, fig. 153; appendage of claspette very long and slender; a membranous "island" above macrochaeta. ....10. *stimulans*
19. Apical lobe short, appendage of claspette elongate with a narrow necklike base, fig. 157. ....13. *grossbecki*  
 Apical lobe very long, fig. 156, or appendage of claspette without a basal neck, fig. 154 .....20
20. Basal lobe with membranous, setiferous portion hidden behind sclerotized ventral shoulder, fig. 158, which projects ventro-mesad. ....22. *implacabilis*  
 Basal lobe with membranous, setiferous portion well exposed from ventral aspect, and without a projecting ventral shoulder, figs. 154, 156. ....21
21. Basal lobe with sparse and moderately short setae, without a sclerotized band along the dorsal and mesal periphery; apical lobe with abundant setae on mesal face, fig. 156. ....23. *punctor*  
 Basal lobe with abundant longer setae which form a thick brush, and with a sclerotized collar around the dorsal and mesal periphery, fig. 154; apical lobe with a few long setae on mesal face. ....11. *fitchii*

## THE SUBGENERIC UNITS

An investigation of characters of the female genitalia indicates that the subgenera represented in the Illinois *Aedes* fauna are readily segregated on these characters. In those subgenera in which we have more than one species, either no differences were found among the included species (in the case of *Taeniorhynchus*), or the differences observed among the various species were so slight and of such a comparative nature that it was impractical to use them as a basis for identification. These findings follow closely those of Gjullin (1937), who treated western species of the genus.

DIAGNOSIS OF SUBGENERA REPRESENTED  
IN ILLINOIS

(BASED ON FEMALE GENITALIA)

1. Postgenital plate elongate, extending three-fourths distance to tip of cerci; eighth segment large and well sclerotized, with short basal membrane, fig. 160. Sole Illinois species, *triseriatus* . . . *Finlaya*  
Postgenital plate shorter, its tip not reaching half the distance to tip of cerci, fig. 159 . . . . . 2
2. Apical margin of eighth sternite with a deep mesal cleft or incision, figs. 159, 163 . . . . . 3  
Apical margin of eighth sternite with only a shallow indentation, fig. 164, or transverse, fig. 167 . . . . . 4
3. Cerci little longer than ninth tergite; postgenital plate with rounded apex; eighth segment nearly as high as long, fig. 163. Sole Illinois species, *aegypti* . . . . .  
 . . . . . *Stegomyia*  
Cerci nearly twice as long as ninth tergite; postgenital plate with apex notched; eighth segment nearly twice as long as high, fig. 159. Sole Illinois species, *vexans* . . . . . *Aedimorphus*
4. Eighth tergite and sternite almost entirely membranous, with minute sclerotized spots at bases of some setae; apex of eighth sternite forming a moderately sclerotized "flap," which is slightly incised on meson, fig. 164. Only Illinois species, *solicitans* and *mitchellae* . . . . .  
 . . . . . *Taeniorhynchus*  
Eighth segment moderately and uniformly sclerotized throughout the principal sclerites . . . . . 5
5. Eighth segment nearly as high as long, the sternite with its apical margin sinuate and not projecting beyond the tergite; cerci short; postgenital plate with a deep cleft, fig. 166. Sole Illinois species, *cineus* . . . . . *Aedes*

Either segment much longer than high, fig. 167, or sternite with nearly straight apical margin, projecting markedly beyond tergite, fig. 162; cerci frequently long, fig. 167, and postgenital plate usually with only a shallow cleft. Contains most of the Illinois species of the genus . . . . . *Ochlerotatus*

Subgenus *Finlaya* Theobald1. *Aedes triseriatus* (Say)

LARVA.—Fig. 99. Head slightly longer and more rounded than in most other members of the genus; upper head hairs long, slender, and single or double; lower head hairs shorter, double to quadruple, and having between them a pair of distinct plumose tufts. Eighth segment with comb forming a single row varying from a regular one composed of 6 or 8 teeth to a dense, irregular row consisting of 10 to 14 teeth. Air tube about three times as long as wide, both the dorsal and ventral margins curving to form a tapered apex; hair tuft long, single or double, and situated beyond pecten; pecten with 15 to 20 fairly even and quite regularly spaced, closely set teeth. Anal segment with dorsal plate covering only the dorsal half of the segment and bearing a multiple tuft at its postero-ventral corner; anal gills rounded at apex, short, the ventral pair shorter than dorsal pair.

FEMALE.—Length of wing 4 mm. Beak and palps black scaled; back of head silver scaled. Mesonotum with a black central portion and silver lateral areas forming a pattern shown in figs. 120, 121; there is considerable variation in the shape of these markings. Pleural areas with patches of very dense silvery scales. Abdomen with dorsum chiefly blue-black scaled, segments 4-7 with lateral patches of white scales which are smallest on 4, increase posteriorly and usually form a solid white band on 7, venter conspicuously banded with black and white, the white predominating. Legs with tibiae and tarsi blue black, femora with basal half cream, apex blue black, sometimes the anterior face almost entirely blue black. Wings entirely dark scaled.

MALE.—Color identical with that of female. Palps extremely long, projecting beyond beak. Male genitalia, fig. 137, characterized as follows: basistyle without definite apical or basal lobes, the meso-basal portion of the ventral aspect having a large loose brush and dorsal portion having a

conspicuous tuft near middle of mesal edge. Claspettes prominent, the base stout and short, the apical process long and slightly curved at apex.

Breeding primarily in water in tree hole cavities, this species is distributed over the entire state. The adults are sharp biters but apparently do not wander far from the woods in which occur their breeding places. In periods when the rainfall and sap flow refill the tree holes frequently during the summer, this species breeds almost continuously. Development of the larvae is very slow compared to that of species which occur in ground pools. The few observations we have made indicate that the larvae may require nearly a month during the summer to reach maturity. The species hibernates in the egg stage.

Recorded from the Chicago area by Gerhard in 1910, the species was listed as widespread throughout the state by Matheson in 1930.

**Illinois Records.**—Larvae, collected May 16 to September 16, and adults, collected May 10 to October 22, are from Belleville (USPHS), Cahokia (USPHS), Camp Grant (USPHS), Camp Ellis (USPHS), Chicago, Carterville (USPHS), Crab Orchard Lake (USPHS), Danville, Des Plaines, Dongola, Dubois, East St. Louis, Elsah, Epworth, Glencoe, Gorham, Great Lakes Naval Training Station, Havana, Homer, Johnston City (USPHS), Kappa, La Rue, Lawrenceville (USPHS), Mahomet, Marion (USPHS), Mascoutah, Mount Carmel, Mount Vernon (USPHS), Muncie, Oak Park, Oakwood, Onarga, Pike, Pulaski, Ravinia, Rising Sun, Rockford (USPHS), Roxana, St. Jacob, Scott Field (USPHS), Springfield, Starved Rock State Park, Urbana, Ware, Weldon Springs, and White Heath.

### Subgenus *Stegomyia* Theobald

#### 2. *Aedes aegypti* (Linnaeus)

**LARVA.**—Fig. 112. Head somewhat oval; preantennal hair and upper and lower hairs all very delicate, long, and single; upper hairs almost directly on a line between the two preantennal hairs; lower hairs anterior to upper hairs but situated close to anterior margin of head and with a pair of delicate tufts between them. Eighth segment with comb consisting of a single arcuate row of about 10 toothed scales. Air tube short and relatively stout, about two and one-half times as long as wide and with its ventral margin slightly concave; hair tuft fairly

short, usually quadruple, situated just beyond end of pecten; pecten consisting of a close regular row of small teeth. Anal segment with a ventral membranous strip between edges of sclerotized band; each pre-apical dorsal tuft with three to four filaments, apical dorsal tufts each with two, the filaments of both of about equal length; anal gills sausage shaped and about as long as siphon.

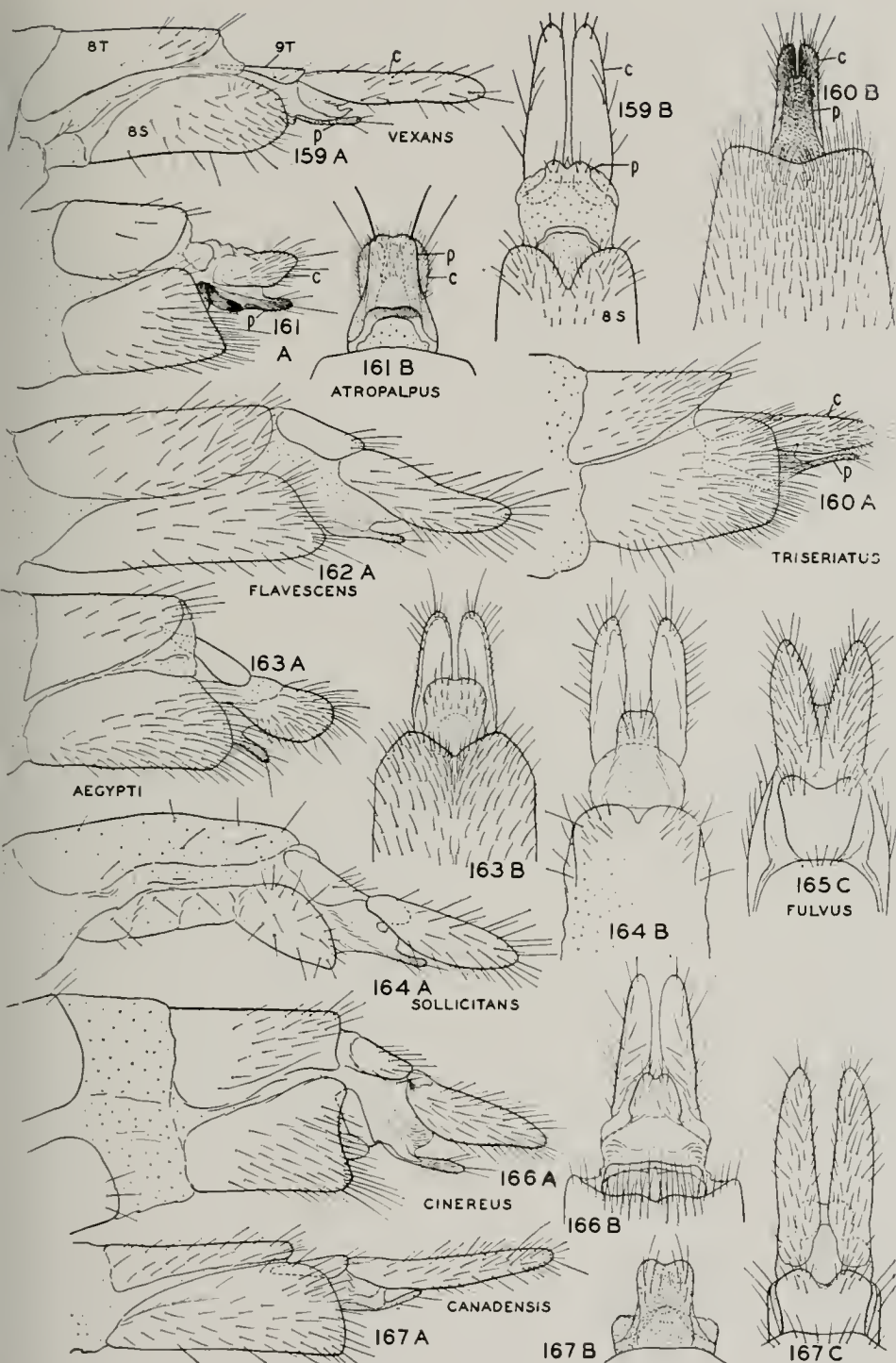
**FEMALE.**—Figs. 114, 128, 129. Length of wing 3.5 mm. Entire body and appendages clothed with very dark brown or black scales having many small and narrow silver spots and stripes, as follows: head with spots at apex of palps, base of antennae and other places; mesonotum with two conspicuous lateral stripes curved so that both form a lyre-shaped pattern, with fainter mesal stripes and three white spots on scutellum; pleurae with several patches of silver scales; abdomen with a narrow white basal band on each segment, with a conspicuous large silver spot on the lateral portion of each tergite, and with the sternites forming a narrow whitish area between these; hind tibiae with a broad white band at the base of each segment, middle and front legs with white bands on only the basal two segments; tibiae black; femora with small white kneecaps and stripes of silver scales along the anterior faces and much of the ventral faces. Wings entirely dark scaled.

**MALE.**—Similar in size and color to female with the exception of the palps, which are very long, have no apical brushes, and have well-defined conspicuous white bands at the base of each segment. Male genitalia, fig. 134, with very broad robust basistyle, dististyle terminal and simple, and claspettes completely absent.

This species, the widespread yellow-fever mosquito of the South, has been taken at only one or two isolated points in Illinois. In this state it seems to be restricted to isolated small populations that occur as adventives. Apparently none of the introductions has persisted longer than a single summer. The records listed below from Edwardsville appear to be based on the introductions of adults with merchandise; probably no breeding or colonization resulted.

Apparently this mosquito, one of the most important vectors of yellow fever, does not occur in Illinois naturally and is not able to establish itself permanently even when introduced.





Figs. 159-167.—*Aedes* female genitalia. A, lateral aspect; B, ventral aspect; C, dorsal aspect. Abbreviations: c, cercus; p, postgenital plate; s, sternite; t, tergite. Fig. 167B shows only the postgenital plate.

Illinois Records.—BELLEVILLE: Aug. 6, 1942, C. J. Rohde, 1 ♀ (USPHS); Aug. 26, 1942, chicken coop, 1 ♀ (USPHS). EDWARDSVILLE: Sept. 24, 1943, biting in shop, Ross & Sanderson, 4 ♀; Oct., 1943, Ross & Sanderson, 1 ♂, 6 ♀. WATERLOO: Sept. 14, 1942, J. Williams, 1 ♀ (USPHS).

### Subgenus *Aedimorphus* Theobald

#### 3. *Aedes vexans* (Meigen)

LARVA.—Fig. 102. Head with upper hairs sometimes triple, sometimes quadruple, lower hairs double or triple, both of moderate length and without tufts between them. Eighth segment with comb variable, ranging from 6 to 12 teeth arranged in a scattered single row or an irregular double row. Air tube three and one-half to four times as long as wide; hair tuft short, usually quadruple, situated well beyond the pecten; pecten with 17 to 25 teeth, the basal teeth small, one to three apical teeth very large, widely separated from the remainder of the pecten, and, if more than one, from each other. Anal segment with sclerotized ring not complete ventrally; anal gills longer than ring, tapering gradually and pointed at apex, sometimes nearly as long as the air tube.

FEMALE.—Length of wing 4.5 mm. Head variegated with gray and brown, palps mostly brown-and-black scaled, with a small patch of white scales at apex. Mesonotum almost uniformly dark-brown scaled except for irregular posterior and lateral patches of gray scales. Abdomen with dorsum conspicuously banded, each segment with a basal white band and an apical bluish-brown band; the apical tergites frequently have an additional narrow white band of scales and the basal white bands are usually very narrow on the meson; venter of abdomen almost entirely white scaled. Legs, fig. 127, with tarsi black, each segment with a basal white band; these white bands may be extremely narrow on all the segments but are always conspicuous on the posterior tarsal segments and may occupy a quarter of the length of each segment. Wings entirely bluish-brown scaled.

MALE.—In size and color similar to female, differing chiefly in the long palps, which have a white-scaled band at the base of each segment. Genitalia, fig. 133, readily distinguished by the following characteristics: basistyle with only an inconspicuous

basal swelling; dististyle with the apical spine prominent and arising a short distance from the apex, this spine and the pointed apex usually appearing as a fork; claspettes short and surmounted by a tuft of short setae.

The commonest mosquito in Illinois in point of numbers throughout the warmer months of the year, *Aedes vexans* has a range that blankets the entire state. It is a vicious biter and breeds in a wide variety of temporary pond situations. Especially abundant after the summer rains, when it emerges in clouds from many types of rain pools and the flooded edges of marshes, *vexans* is the greatest mosquito nuisance in the state. To date the species is not known to transmit human diseases.

There is a great deal of literature on this mosquito. Formerly it was recorded as *sylvestris* Theobald. Holarctic in distribution, it does not extend in numbers into the extreme southern United States but is abundant at least as far south as southern Illinois.

The species may have several generations each year. The first brood of adults typically emerges in early spring, a week or so after emergence of *canadensis* and *sticticus*.

Illinois Records.—Larvae, collected April 3 to September 9, and many males and females, collected April 5 to October 26, are from Algonquin, Allendale, Altamont, Amboy, Antioch, Arcola, Baker, Beach, Belleville (USPHS), Benton, Bensenville, Billett, Bishop, Bourbonnais, Cache, Cahokia (USPHS), Cairo, Calvin, Camp Ellis (USPHS), Camp Grant (USPHS), Carbonale (USPHS), Carterville (USPHS), Cary, Casey, Cave-in-Rock, Central City, Champaign, Channel Lake, Chanute Field (USPHS), Charleston, Chebanse, Chemung, Chester, Chicago, Cordova, Danville, Darwin, Del Rio, Des Plaines, Downs, Duncans Mills, Dupo, East Dubuque, East Moline (USPHS), East Peoria (USPHS), East St. Louis, Edwardsville, Effingham, Eichorn, Eldorado, Elgin, Elizabethtown, Elsau, Epworth, Farmer City, Fort Massac State Park, Fox Lake, Fox Ridge State Park, Frankfort, Franklinville, Fulton, George Field (USPHS), Gilman, Glencoe, Golconda, Gorham, Gossett, Grafton (USPHS), Grand Tower, Granite City (USPHS), Grantsburg, Grass Lake, Grayslake, Grayville, Great Lakes Naval Training Station, Halfday, Hamel, Hardin, Harding, Havana, Hazel Crest, Hebron, Herod, Herrin, Homer, Horse Shoe Lake, Jerseyville, Joetta, Johnston City (USPHS), Joliet, Kampsville, Kankakee, Kappa, Karnak, Kcensburg, Keithsburg, La Grange, Lake Bluff, Lake Fork, Lake Glendale, Lake Villa,

La Rue, La Salle, Lawrenceville (USPHS), Libertyville, Lincoln, Mahomet, Makanda, Marissa, Mascoutah, Mattoon, Mazon, McHenry, Metropolis, Mill Shoals, Mississippi Palisades State Park, Momence, Monticello, Morris, Mount Carmel, Mount Vernon, Mount Zion, Muncie, Neoga, New Boston, New Haven, New Holland, Northmoor, Oak Park, Oakwood, Oilfield, Olney, Oregon, Orland Park, Oswego, Palatine, Palestine, Palos Park, Patton, Pecatonica, Pembroke, Peoria (USPHS), Pere Marquette State Park, Pike, Pingree Grove, Pittsfield, Princeton, Quincy, Ravinia, Reynoldsville, Richmond, Ridge Lake, Rising Sun, River Forest, Robinson, Rockford, Rock Island (USPHS), Rockton, Rosecrans, Rossville, Round Lake, Roxana, Russellville, St. Charles, St. Jacob, St. Joseph, Salem, Sandoval, Savanna (USPHS), Scott Field, (USPHS), Seneca (USPHS), Seymour, Shawneetown, Skokie, Springfield, Starved Rock State Park, Sugar Grove, Sullivan, Thomson, Urbana, Utica, Venedy Station, Vienna, Viola, Volo, Wadsworth, Waltersburg, Ware, Watseka, Wauconda, Waukegan, Wedron, West Vienna, Wetaug, White Heath, White Pines Forest State Park, Willow Springs, Winnetka, Wolf Lake, Woodstock, Yorkville, and Zion.

Subgenus *Taeniorhynchus* Arribáizaga

4. *Aedes sollicitans* (Walker)

LARVA.—Fig. 98. Head fairly wide, with short, tufted preantennal hairs and usually single (rarely double) upper and lower hairs, the lower hairs almost directly anterior to upper ones and without intervening tufts. Eighth segment with comb forming an irregular scattered triangle, composed of about 14 to 20 small scales. Air tube short and robust, two to two and one-half times as long as wide; hair tuft multiple branched, situated beyond pecten, and of moderate length; pecten forming a close and even series of about 20 teeth, the apical two or three usually more widely separated than the others. Anal segment completely ringed with sclerotized plate; anal gills very short, budlike.

FEMALE.—Length of wing 4.5 mm. Beak black, with a wide white band near middle, palps black tipped with white, dorsum of head golden. Mesonotum predominantly golden-brown scaled, the lateral areas and sometimes a mesal stripe darker brown. Pleurae with many white scales. Abdomen with tawny scales forming a fenestrated pattern made up of narrow basal bands and a wider mesal band of tawny scales against a blue-black background, very similar to

fig. 119; lateral portions of tergites each with a patch of white scales contrasting noticeably with the tawny scales; venter with a mixture of white and tawny scales. Legs, fig. 130, for the most part with a salt-and-pepper mottling of tawny scales and black scales; tarsi definitely banded with the apical portion black scaled, the basal portion white scaled. Hind tarsi with apical segment almost entirely white scaled, second, third, and fourth segments each with a basal band of white scales that cover a third to a half of the segment; basal segment with a basal band of white scales and a central band of tawny scales, the latter about as long as half the segment. Wings with a mottled appearance, the scales along all the veins being a salt-and-pepper mixture of dark scales and light scales.

MALE.—Similar in general to female with the following differences: beak without a definite band, the apical two-thirds being chiefly tawny scaled; palps very long and with distinct apical brushes, the basal segment being mostly tawny scaled. Male genitalia, fig. 138, of a very simple type. Basistyle nearly parallel sided, with a slight indication of a basal lobe, bearing at this point a cluster of hairs. Claspettes of moderate length, with a long apical blade curved at apex.

This species was recorded from Illinois by Chandler (1920) and by Matheson (1930), and has since been taken at a few scattered localities. Each occurrence has been associated with salt water from mine or oil well drainage. In two instances, at Dupo and at Central City, the species occurred in tremendous numbers. The severe and persistent biting led in each case to the organization of local control measures. In the Dupo area the salinity of water in which breeding occurred was three times the average for ocean water.

Like *vexans*, this species is an intermittent breeder. The eggs, which are laid in dry places, hatch at subsequent floodings, and there are new outbreaks of adults following most summer rains. The larvae develop very rapidly after hatching, and a wave of adults follows in quick succession.

Illinois Records.—Many larvae, collected March 18 to October 27, and adults, collected April 29 to October 14, are from Benton, Cahokia (USPHS), Carterville (USPHS), Central City, Centralia, Chanute Field (USPHS), Crab Orchard Lake (USPHS), Dupo, Granite City (USPHS), Herrin, Johnston City (USPHS), Law-



renceville (USPHS), Mount Vernon (USPHS), Savanna (USPHS), Scott Field (USPHS), West Frankfort, White City (USPHS), and White Heath (USPHS).

### 5. *Aedes nigromaculis* (Ludlow)

LARVA.—Head similar to that of *sollicitans*, having upper and lower head hairs single. Eighth segment with comb forming an irregular scattered triangle composed of 14 to 20 scales. Air tube short and robust, two to two and one-half times as long as wide; hair tuft beyond pecten multiple branched and short; pecten occupying most of the length of the tube with several conspicuously detached teeth at the apex. Anal segment completely encircled by sclerotized ring. Anal gills twice as long as anal segment, pointed, representing the chief difference between this species and *sollicitans*.

ADULTS.—In length and color almost identical with those of *sollicitans*, differing in the coloration of the abdomen, in which the dorsal, mesal, and lateral bands of pale scales are all practically pure white. The width of the white band on the beak and the central band of pale scales on the hind basitarsus both vary considerably, sometimes represented by only a few pale scales. No characters have yet been found to separate satisfactorily the male genitalia of *sollicitans* and *nigromaculis*.

A western species, *nigromaculis* has so far been taken only once in Illinois. A single female was caught in the light trap at the Savanna Ordnance Depot, July 7, 1945, and collected by S. Mittler. This record was first discovered by Captain Charles F. Gerlach, U. S. Public Health Service, to whom I am greatly indebted for information regarding it.

No larvae of this species have yet been taken in the state. The species frequents saline pools throughout the great plains area and westward.

### 6. *Aedes mitchellae* (Dyar)

LARVA.—Head similar to that of *sollicitans*. Eighth segment with comb more compact than in *sollicitans*. Air tube somewhat slender, more than three times as long as wide; hair tuft usually seven branched, situated beyond pecten; pecten composed of a close row of small teeth. Anal segment completely ringed by sclerotic shield; anal

gills slender and pointed, slightly longer than anal segment (after Dyar).

FEMALE.—Similar in size and almost all particulars of color and structure to the female of *sollicitans*, differing chiefly as follows: hind basitarsus having no center band of tawny scales, being black scaled with a basal band of white scales; tibiae predominantly black with a conspicuous scattering of white scales on the anterior face; wings entirely dark scaled.

MALE.—Genitalia, fig. 136, very similar in most particulars to those of *sollicitans*, differing chiefly in the round and projecting basal lobe. The setae on this lobe are longer than in *sollicitans*.

This species is primarily southeastern in distribution. Our only record for Illinois is a single female collected on the south side of Chicago, May 18, 1906, by Charles A. Hill; it was recorded as *Aedes taeniorhynchus* (Wiedemann) by Gerhard in 1910. The lack of subsequent records indicates strongly that it represents an adventive. The specimen probably came north by train.

### Subgenus *Aedes* (Meigen)

### 7. *Aedes cinereus* Meigen

LARVA.—Fig. 101. Head wide and relatively short; upper and lower hairs each with four to seven filaments, the lower hair almost directly laterad of the upper hair and only slightly anterior to it; no accessory tuft between or in front of upper and lower pairs. Eighth segment with comb forming an irregular line or an irregular triangle of 10 to 15 large well-separated teeth. Air tube moderately elongate, about four and one-half to five times as long as wide; hair tuft short, usually quadruple, situated beyond pecten; pecten with about 14 teeth, the basal ones very small, the apical ones very long and widely separated. Anal segment with the tergite encompassing only about one-half the segment; anal gills slender and sharp, about as long as the air tube.

FEMALE.—Length of wing 4 mm. Head, including beak and palps, dark brown to black. Mesonotum entirely reddish-brown scaled with a few postero-lateral and postero-mesal areas of grayish scales. Abdomen with dorsum almost entirely bluish-black scaled, the base of each segment with a narrow crescent of cream scales at the base; venter of abdomen almost entirely white or cream scaled. Legs with tibiae and



tarsi entirely bluish-black scaled, the femora with the anterior faces usually dark, the posterior faces whitish. Wings entirely dark scaled.

**MALE.**—In size and general color similar to female. Palps represented by short stubs, very similar to those of the female and entirely unlike those of any other Illinois species of the genus. Abdomen with basal white bands more pronounced than in the female. Male genitalia, fig. 135, differing from all others in the genus by the following distinctive characters: dististyle inserted some distance from the apex of the basistyle; dististyle with prominent sclerotized processes at base and having apex divided into a Y-shaped fork; basistyle with a pointed, projecting apex, a broad base bearing a sharp basal lobe, and also a branched sclerotized mesal lobe; claspettes entirely lacking.

This mosquito, which is crepuscular and a ready biter in the vicinity of its larval habitat, is common in the many small water holes that abound in the glacial bogs and marshes in the northeastern corner of the state. Apparently it produces annually only one generation, which emerges in late May or early June.

*Aedes cinereus* was formerly known under the name of *fuscus* Osten Sacken, and a specimen was so recorded from Glen Ellyn, Illinois, May 30, 1908, by Gerhard (1910). In addition to many records of the species from northeastern Illinois, we have scattered records from other parts of the state, especially the southern fourth. The records from southern Illinois were associated with (but not reared from) woodland pools.

**Illinois Records.**—Antioch, Cahokia (USPHS), Cairo (USPHS), Camp Grant (USPHS), Carterville (USPHS), Crab Orchard Lake (USPHS), Chemung, Elgin, Glencoe, Gorham, Great Lakes Naval Training Station, Kankakee, Keithsburg, Lawrenceville (USPHS), Pingree Grove, Ravinia, Roxana, Scott Field (USPHS), Skokie, Springfield (USPHS), Volo, Wauconda, Waukegan, and Zion.

Subgenus *Ochlerotatus* Arribáizaga

## 8. *Aedes excrucians* Walker

**LARVA.**—Fig. 103. Length 10 mm. Head wide. Lower head hairs usually double, upper head hairs usually triple, but frequently double, and any of the four occasionally single. No accessory hairs or tufts between them. Air tube elongate, about

five times as long as wide; pecten with one to three apical teeth detached, ventral tuft situated beyond the pecten and very long. Lateral comb consisting of an irregular patch of about 25 scales. Anal segment with dorsal shield covering little more than one-half the segment, the anal gills about as long as the segment, narrow and tapering.

**FEMALE.**—Length of wing 6 mm. In color and general characteristics, this species is very similar to *stimulans*, differing as follows: mesonotum usually with much more extensive reddish-brown areas and meso-epimeron without bristles.

**MALE.**—In color and general structure similar to male of *stimulans*. Genitalia, fig. 155; similar in general proportions to those of *stimulans* but differing markedly as follows: ventral aspect of basistyle seeming to have basal lobe projecting as a triangular area; in reality the basal lobe is a large and somewhat rectangular area folded back against the mesal face, covered with rows of short fine setae and without any indication of a macrochaeta.

To date we have found this species in only the northeastern corner of the state, where it inhabits the spring pools in some of the marshes and bogs. It appears to favor marsh situations that border woods and is found usually in company with *stimulans* and *fitchii*. It has only a single generation per year, and its habits are very similar to those of *stimulans*. We have never found it in Illinois in the tremendous numbers that characterize colonies of *stimulans*. Matheson (1930) recorded the species from several localities in northeastern Illinois. In addition, he gave a record from Urbana, which is in the central part of the state; this specimen, however, appears more like *fitchii*, although it is in very poor condition and does not provide a good basis for a definite record.

*Aedes excrucians* is Holarctic in distribution. In North America it is restricted to the northern coniferous forest belt and areas a short distance southward. Our Illinois records appear to be on the southern limit of its range in this longitude.

**Illinois Records.**—BEACH: June 10, 1933, Mohr & Townsend, 1♀. ELK GROVE: May 2-6, 1942, 11♂, 21♀, 6 larvae. Volo: April 24, 1942, Ross & Burks, April 29, 1942, Ross & Samuels, 12 larvae; May 4-5, 1942, Ross & Burks, 1♀, 5 larvae. WADSWORTH: June 3, 1943, Ross & Sanderson, 8♂; June 10, 1942, Ross & Sanderson, 17♂, 1♀. WAUCONDA:

April 21, 1942, Ross & Riegel, 1 larva; April 29, 1942, 3 ♂.

### 9. *Aedes flavescens* Müller

LARVA.—Head wide, upper and lower hairs multiple, the upper ones sometimes double. Eighth segment with comb forming a triangular patch of scales. Air tube over three times as long as wide, the pecten reaching the middle, with the last two teeth detached. Anal segment with dorsal plate covering only the dorsal half of the segment. Anal gills as long as the anal segment and tapering to a point.

FEMALE.—Length of wing 7 mm. Head and mesonotum golden brown with areas shading to a more yellowish cast. Beak and palps black with white scales scattered along the entire length. Dorsum of abdomen entirely cream scaled. Legs, except for the tarsi, mostly cream scaled. Basitarsus a mixture of white and black scales, the apical tarsal segments with the basal halves entirely white scaled, the apical halves dark scaled. Wings almost entirely cream scaled with a few black scales mixed in with them.

MALE.—In size and general color similar to female, palps with an apical brush. Genitalia, fig. 152, as follows: apical lobe large and projecting; basal lobe large and triangular, with many short setae and a single large conspicuous macrochaeta; claspette having a short stout base with fairly long apical filament, and beyond this a long narrow neck and enlarged apical head which tapers to a narrow tip.

To date we have taken only isolated adults of this species from the state, all from the northeastern portion, from near the Wisconsin border to Kankakee, some 100 miles farther south. The males we took in the vicinity of marshes in which the larvae probably breed.

Our records for this species, which is Holarctic in distribution, are on the southern edge of its range. The Illinois records given by Matheson (1930) for this species from Algonquin prove to be for *fitchii*, but our present records from Franklinville and Woodstock are close to Algonquin. The species is believed to have only one generation per year and the adults seldom are abundant enough to be a nuisance.

ILLINOIS RECORDS.—ANTIOCH: May 21, 1941, 1 ♂, 1 ♀. FRANKLINVILLE: June 4, 1943, marsh

pond, Ross & Sanderson, 1 ♂. KANKAKEE: Aug. 4, 1938, Burks & Boesel, 1 ♀. WOODSTOCK: June 4, 1943, cattail marsh, Ross & Sanderson, 1 ♂. ZION: June 19, 1941, 1 ♀; June 10, 1942, Mohr & Burks, 1 ♀.

### 10. *Aedes stimulans* Walker

LARVA.—Fig. 104. Length 9 mm. Head wide, lower head hairs usually single, rarely double, upper head hairs usually double but occasionally single, triple, or quadruple. Eighth segment with lateral comb forming a rough triangle of about 30 scales. Air tube about three and one-half times as long as wide; pecten composed of an even series, the ventral tuft situated beyond it, usually three haired, and longer than width of segment at base of tuft. Dorsal shield covering little more than half of segment; gills pointed and usually slightly shorter than segment.

FEMALE.—Length of wing 6 mm. Beak and palps with a mixture of brown scales and white scales. Mesonotum varying from grayish brown to reddish brown, with gray-scaled stripes or areas along the lateral half and always nearly covering the scutellum. Mesopleurae with a group of three to six epimeral bristles. Dorsum of abdomen mostly dark scaled, each segment with a basal band of white scales, the bands small and crescentic on the basal segments, becoming wider and more extensive toward the apex. Hind tarsi with basal segments mostly white scaled; second, third, and fourth dark scaled with a basal white band occupying about a third of the segment. Wings mottled with brown scales and white scales, the dark ones predominating.

MALE.—Similar to female in color and structure. Palps with apical brushes. White bands on abdomen usually much more extensive. Male genitalia, fig. 153: basistyle with well-developed apical lobe; basal lobe developed as a large mesal lobe bearing many short setae and a large macrochaeta, but projecting only slightly as seen from ventral view; claspette curved and narrow, its apical filament elongate with a long slender base, a sharp upper projection near middle, and from this point gradually tapering to a slender curved tip.

Three *Aedes* species, *stimulans*, *excrucians*, and *fitchii*, form a group the females of which are frequently difficult to identify. The characters given in the key are not infallible, but will serve to separate most

specimens. Characters of larvae and of male genitalia offer very satisfactory means of diagnosis.

*Aedes stimulans* occurs in tremendous numbers in and near woodland pools and stump holes in the northeastern corner of Illinois. The larvae, which appear shortly after the annual spring thaw, develop slowly, but are usually full grown by the time the first warm weather of late May occurs. The adults soon emerge, and during June and early July many woods in the vicinity of northeastern Illinois are teeming with voracious biters. The species has only one generation per year. Outside of the northeastern corner of the state, we have records of isolated colonies as far south as the central portion of the state. Early records of about 1906 and 1910 indicate that this species may have been much more abundant in central Illinois during the early part of the century, before so many extensive tracts of upland timber were cleared.

The range of *stimulans* is widespread throughout the northeastern states, across the north central states, through Canada, and into the Yukon. Illinois is on the southern limit of its range.

**Illinois Records.**—Larvae, collected April 15 to April 25, and adults, collected April 28 to July 20, are from Algonquin, Antioch, Bensenville, Bishop, Camp Grant (USPHS), Elk Grove, Glencoe, Gurnee, Halfday, Highwood, Momence, Muncie, Northmoor, Palatine, Princeton, Ravinia, River Forest, Rockford, Rock Island, Rondout, Rosecrans, Starved Rock State Park, Urbana, Utica, Volo, Wadsworth, Waukegan, Yorkville, and Zion.

## II. *Aedes fitchii* Felt & Young

**LARVA.**—Fig. 109. Length 9 mm. Head wide, lower hairs usually double, occasionally single or triple, upper hairs usually triple, occasionally double, and rarely quadruple. Lateral comb somewhat triangular, composed of about 25 scales. Air tube elongate, about five times as long as its width near middle of pecten, tapering markedly and gradually from base to apex; pecten consisting of 20 to 25 scales forming an even row; ventral tuft situated just beyond pecten and very long. Anal segment with dorsal shield covering nearly two-thirds of segment; anal gills longer than segment and pointed.

**FEMALE.**—Length of wing 6 mm. Color and general structure in general as for *stim-*

*ulans* with the following diagnostic features: head gray, mesonotum with the mesal third bright reddish brown, the lateral third hoary gray with a few reddish-brown scaled areas, scutellum gray; meso-epimeron usually with only two bristles.

**MALE.**—In size and general color similar to female. Genitalia, fig. 154: basistyle with projecting rod, apical lobe bearing a scattering of long setae projecting mesad; basal lobe large and bearing a dense cluster of very fine long setae, in addition to the basal macrochaeta. Claspette with basal portion nearly straight, the apical filament short and curved, bladelike, and with its underside notched at the extreme base.

Both Gerhard (1910) and Matheson (1930) recorded this species from Illinois. Most of our recent records for it are from the northeastern corner of the state. Here the species breeds in abundance in practically every open marsh. It is usually found associated with *Culiseta inornata* or *Aedes excrucians*, but in some marshes it occurs as a pure colony. Our only records south of northern Illinois were obtained by Hart from Urbana in 1887 and from Havana in 1892. We have a recent record taken from Savanna, which is in the extreme northwestern part of the state. The species has apparently only one generation per year.

Our Illinois records appear to be on the southern limit of the range of this species, which has a wide northern distribution similar to that of *stimulans*.

**Illinois Records.**—Larvae, collected April 29 to June 10, and adults, collected May 3 to October 5, are from Algonquin, Antioch, Elk Grove, Franklin (Cook County), Franklinville, Glencoe, Great Lakes Naval Training Station, Halfday, Lake Bluff, Orland Park, Palos Park, Ravinia, River Forest, Sand Lake, Savanna, Urbana, Volo, Wadsworth, Waukegan, Willow Springs, Woodstock, and Zion.

## 12. *Aedes thibaulti* Dyar & Knab

**LARVA.**—Head, fig. 97, wider than long; preantennal and both upper and lower head hairs long, the lower head hairs usually quadruple, the others with five or more branches; clypeal hairs very wide apart, three-quarters as far apart as distance between upper head hairs; lower head hairs considerably laterad of and only slightly anterior to upper hairs; antennae very long, over three-quarters as long as head, antennal tuft very long. Eighth segment with comb



consisting of a trianguloid patch of scales. Air tube about four and one-half times as long as wide, with pecten consisting of about 20 scales arranged in an even row, ventral tuft situated just beyond pecten, usually six branched, the branches longer than the greatest width of the tube. Anal segment with dorsal shield longer than wide, covering about two-thirds of the segment; anal gills about as long as segment, tapering to a blunt tip.

**FEMALE.**—Length of wing 4 mm. Beak and palps black, head gray. Mesonotum, fig. 122, with a bluish-black mesal patch that is narrow on the anterior half of the mesonotum but that on the posterior half occupies nearly the entire width of the segment. Antero-lateral areas of the mesonotum are a bright gray, with scales long and slender and not forming a shingled patch; abdomen bluish black with small white lateral patches at the bases of most of the segments; legs with tibiae and tarsi entirely black, femora with anterior and apical portions black, with conspicuous white knee rings and white basal areas; wings entirely brownish-black scaled.

**MALE.**—Similar in size and color to female; palps very long and with apical brushes. Male genitalia, fig. 139, with broad basistyle that has a prominent apical and basal lobe and peculiar claspettes; the claspette blade is contorted into a somewhat irregular hook-shaped structure unlike that of any other North American species in the genus. Otherwise, the species shows a marked affinity to *trivittatus*, on the basis of the small but definite apical and basal lobes of the basistyle.

Published records indicate that this species is primarily a south central species and has been found in abundance in Arkansas. The Illinois records represent the most northern locality in which the species has been taken. An excellent account of its life history is given by Horsfall (1940). It usually breeds in holes within the bases of standing trees. It seems to prefer swamp situations and, according to some writers, shows a marked preference for the bases of sweet gum and tupelo gum trees.

**Illinois Records.**—CAHOKIA: June 29, 1943, Snow, 1 ♂ (USPHS). CARTERVILLE: June 27, 1942, 1 ♀ (USPHS); May 31, 1944, 1 ♀ (USPHS). MARION: June 2, 1942, Johnson, 1 ♂ (USPHS). SCOTT FIELD: June 25, 1942, 2 ♀ (USPHS); June 16, 1943, 2 ♀ (USPHS); June 18, 1943, 1 ♀ (USPHS).

### 13. *Aedes grossbecki* Dyar & Knab

**LARVA.**—Fig. 113. Length 10 mm. Head wide, lower hairs usually double or triple, upper hairs usually triple, sometimes double or quadruple. Lateral comb of segment 8 forming a triangular patch consisting of about 30 scales. Air tube three and one-half times as long as wide, tapering only slightly; pecten teeth forming an even row; ventral tuft situated just beyond pecten and as long as, or slightly longer than, width of air tube at base of tuft. Anal segment with dorsal shield covering about one-half of segment; anal gills about as long as segment and tapering.

**FEMALE.**—Length of wing 5 mm. Beak and palps black, with scattered white scales, each palp with a small tuft of white scales at apex; dorsum of head covered with gray and white scales. Mesonotum with an irregular pattern, fig. 118, the lateral area white scaled, the mesal third of the anterior half bright brown scaled and the major portion of the disc of the posterior half black scaled, the posterior border white scaled; these areas are variable and merge one into another. Dorsum of abdomen irregularly scaled, the ground pattern dark scaled with a scattering of white scales, and each segment with an arcuate basal area of white scales. Legs, fig. 124, mostly white scaled, the middle and posterior pair with irregular areas of black scales; hind tarsi banded, segments 2 to 5 with basal third to half white scaled, apex black scaled, basitarsus mostly white scaled but not definitely banded. Wings with a mixture of white scales and black scales. All the wing scales are very wide, fig. 169, a characteristic that sets off this species from all other Illinois members of the genus.

**MALE.**—In size, color, and wing scaling similar to female. Palps with large apical brushes. Male genitalia, fig. 157: basistyle with projecting apical lobe bearing several rows of hairs curved dorsad; basal lobe wide and steplike, the macrochaeta somewhat isolated on the ventral edge, the remainder with a cluster of long setae; claspettes with base curved, apical filament with a slender base and an expanded apex that tapers to a curved sharp tip.

Although not abundant, this species is common throughout the post oak flats along the Mississippi River in extreme southern Illinois. Outside this area only isolated



specimens have been taken, but these extend the known range in the state north as far as Chicago. The only Chicago record is that of Gerhard (1910), who recorded a male from Chicago and a female from Palos Park under the name *Aedes sylvicola* Grossbeck (now considered a synonym of *grossbecki*). The adults of *grossbecki* emerge early in the spring and apparently have only one generation per year. Outside of Illinois the species has been recorded from only a few localities to the South. We have encountered the adults in the field so rarely that we know little of their habits.

**Illinois Records.**—Several larvae, collected April 3, and adults, collected April 6 to June 17, are from Cache, Crab Orchard Lake, Gorham, Grand Tower, La Rue, Mount Vernon, Reynoldsville, St. Jacob, Urbana, and Ware.

#### 14. *Aedes trivittatus* Coquillett

**LARVA.**—Fig. 108. Head fairly wide, upper and lower head hairs always long and single; preantennal hair short and eight-branched; accessory hairs absent. Eighth segment with a triangular comb consisting of short pointed scales. Air tube fairly short and robust, about two and one-half times as long as wide; hair tuft fairly short and six to eight branched, situated beyond apex of pecten; pecten consisting of about 15 fairly long teeth arranged in an almost perfectly regular row. Anal segment completely ringed by sclerotic plate; anal gills long and tapering, frequently twice length of anal segment.

**FEMALE.**—Length of wing 5 mm. Beak and palps black, dorsum of head white scaled. Mesonotum, fig. 115, with a long dark central wedge, flanked on the side by a wide stripe of white scales; the anterior portion of the mesonotum has a dark stripe laterad of the light stripe. Dorsum of abdomen almost entirely dark scaled with small lateral triangles of white scales on the apical segments; venter almost entirely white scaled with black lateral triangles on basal segments. Femora pale scaled with stripes of black scales on apical areas; tibiae and tarsi dark scaled with narrow lines of whitish scales on the ventral edge; wings entirely dark scaled.

**MALE.**—In size and color similar to female. Male genitalia, fig. 151: basistyle with apical lobe only moderately developed, shoulderlike; basal lobe steplike, with a



Fig. 168.—Portion of wing of *Aedes stimulans*.



Fig. 169.—Portion of wing of *Aedes grossbecki*. Note the wide scales on the veins compared with those of fig. 168.

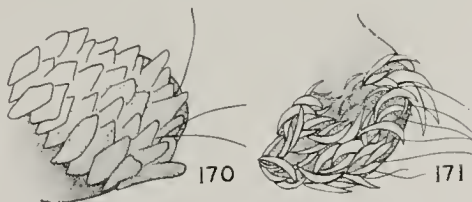


Fig. 170.—*Aedes triseriatus*, scales on pro-notal lobe, lateral aspect.

Fig. 171.—*Aedes thibaulti*, scales on pro-notal lobe, lateral aspect.

very sinuate macrochaeta and many long slender setae. Claspette curved, its apical filament with a definite neck and head, the back of the head produced into one to several spinelike barbs, the tip slender and slightly hooked.

The male of this species is very similar in many respects to that of *infirmatus* Dyar & Knab. In *infirmatus*, fig. 150, the macrochaeta of the basal lobe has a definite thickened angle near the base, the basal lobe itself is diagonal to the main axis of the basistyle, and the basistyle is more slender. The claspettes of the two species are very similar.

*Aedes trivittatus* is one of the extremely annoying species encountered in Illinois. It is a fierce biter, even in the day time, and occurs in a wide variety of temporary pool situations. The adult emergence apparently occurs principally during the late spring, generally later than that of *sticticus* and *canadensis* and frequently coinciding with that of *vexans*. The larvae have been found in shady woodland pools usually resulting from spring rains or spring floods. In our recent collecting, the adults have been encountered in great numbers many times, but the larvae have been taken very seldom and only in small numbers.

In Illinois this species is distributed fairly uniformly over the entire state. Its range covers the northeastern and north central states with a few records extending into the southern states.

**Illinois Records.**—Larvae, collected May 8 to September 17, and many males and females, collected May 4 to November 29, are from Antioch, Baker, Cahokia (USPHS), Camp Grant (USPHS), Carterville (USPHS), Champaign, Chicago, Crab Orchard Lake (USPHS), Danville, Des Plaines, East Peoria (USPHS), East St. Louis, Edwardsville, Glencoe, Great Lakes Naval Training Station, Halfday, Havana, Herod, Homer, Joetta, Kappa, Keithsburg, Lake Fork, Mascoutah, Matanzas Lake, Momence, Muncie, Neoga, New Boston, Oakwood, Pere Marquette State Park, Princeton, Ravinia, St. Jacob, Savanna (USPHS), Scott Field (USPHS), Seneca (USPHS), Seymour, Springfield, Starved Rock State Park, Sycamore, Urbana, Utica, Wadsworth, Ware, Weldon Springs, and Zion.

### 15. *Aedes aurifer* Coquillett

**LARVA.**—Fig. 100. Head wider than long, clypeal bristles moderately far apart. Antennae very long, nearly as long as length of

head, the tuft distinctly beyond middle of antennae and the apical portion markedly more slender than the basal portion. Upper and lower head hairs usually double, occasionally one of them triple, each lower head hair at least twice as far laterad as it is anteriad of upper head hair. Eighth segment with comb varying from an irregular single or double row of about 10 scales to an irregular patch of about 20 scales. Air tube nearly four times as long as greatest width; pecten with 12 to 20 scales, the basal ones very short and broad, the apical 2 or 3 detached from the remainder; ventral tufts multiple and markedly longer than greatest width of tube. Anal segment not completely ringed by sclerotized plate, but with a ventral membranous strip about as wide as in fig. 110B. Gills tapering and of moderate length.

**FEMALE.**—Length of wing 4 mm. Beak and palps black, head varied with golden and dark brown. Mesonotum, fig. 123, having a large central purplish-black area with narrow lateral areas of gray scales shading to gold where the lateral and mesal areas meet, scutellum with a small gray area flanked on each side with a short and very narrow golden line. Dorsum of abdomen almost entirely bluish black, the lateral portion of each tergite having a white patch just visible from dorsal view. Legs with tibiae and tarsi almost entirely blue black, some of the scales gray; femora with apical and dorsal portions black, extreme apex of each with a small white knee spot, basal portion cream. Wings entirely bluish-black scaled.

**MALE.**—In size, color, and general structure similar to female. Palps with a large apical brush. Male genitalia, fig. 141: basistyle moderately narrow with a large tuft of long conspicuous setae at apex; apical lobe set off as a shoulder, its dorsal margin with an irregular linear area of setae curving dorsad; basal lobe represented by a detached sclerotized plate on the mesal face of the basistyle, this sclerite with a scattering of short setae and a single large dorsal macrochaeta arising from the dorsal margin; claspette with a short curved base, the apical blade long, bearing a large barb on its upper surface and tapering to a slender curved apex.

The male genitalia of this species are of the same type as those of *intrudens* Dyar, fig. 142. The two differ somewhat in details

of the claspette and apical tuft of the basistyle, but more particularly in the basal lobe. In *intrudens* the basal lobe bears three macrochaetae, one at the extreme base and two on the dorsal margin.

The range of *aurifer* extends throughout the northeastern and north central states. We have only a single record of the species for Illinois, a female taken in the vicinity of a cypress swamp at Karnak, May 15, 1941, by Mohr & Burks. This specimen was collected considerably south of other *aurifer* records in the western portion of the range of the species. The distinctive color markings of this specimen check perfectly with the markings of specimens from Michigan and Rhode Island.

### 16. *Aedes dorsalis* Meigen

**LARVA.**—Head fairly wide; upper and lower head hairs long, always single, the lower hairs almost directly anterior to the upper ones and without intervening tufts. Eighth segment with comb triangular, composed of small sharp scales. Air tube moderately stout, two and one-half to three times as long as wide, hair tuft about six branched, situated beyond pecten; pecten with about 20 teeth forming an evenly spaced row. Anal segment with sclerotic shield covering only dorsal half of segment; anal gills very short and budlike.

**FEMALE.**—Length of wing 4.5 mm. Most of body and appendages cream to tawny scaled; head tawny brown; mesonotum tawny; usually with a narrow brown mesal stripe and another brown stripe along each lateral margin, fig. 119, sometimes with additional narrow brown stripes and sometimes without any brown stripes; abdomen cream scaled, the basal segments usually each with a pair of lateral spots of dark scales. Legs mostly cream scaled with a mixture of black scales, especially toward the apexes of the femora; tarsi mostly black scaled with a white fringe at the base and apex of each segment. Wings cream scaled, usually but not always with an irregular mixture of black scales on most of the veins.

**MALE.**—In color similar to female except that the brown stripes on the mesonotum are usually darker and wider. The palps have apical brushes as in *canadensis*. Genitalia, fig. 145, as follows: basistyle with apical lobe only moderately developed and square shouldered; basal lobe projecting

and round, with one short and one long macrochaeta and with many slender setae; these setae are very short near the macrochaetae and increase in size to the dorsal margins of the lobe, fig. 145B; claspettes with slender bases, the apical filament of each angled near middle and tapering to a slender tip.

This species is similar in general appearance to *Aedes campestris* Dyar & Knab. The males, however, differ markedly in the setation of the basal lobe. In *campestris*, fig. 146, this lobe bears long setae of almost equal length over the entire surface and has only a single macrochaeta, which is little larger or longer than the other setae. The females are practically impossible to identify; in the past it has been considered that in *dorsalis* the third vein ( $R_{4+5}$ ) was almost entirely dark scaled whereas in *campestris* this vein was largely white scaled. Reared series from individual colonies have shown that this differentiation does not hold, since both extremes and various intermediate conditions occur in *dorsalis* alone.

The first Illinois reports of *dorsalis* were from the suburbs of Chicago and were recorded by Gerhard (1910) using the name *Aedes currici* Coquillett, a name then in use for this species but since that time sunk as a synonym of the Holarctic *dorsalis*. The species was reported from Oak Park, Illinois, by Matheson (1930) as *Aedes dorsalis*. At the same time Matheson recorded four females of *Aedes campestris* from Riverdale, near Chicago, Illinois. There seems no doubt that these Riverdale specimens are true *dorsalis* and not *campestris*, because all males taken in the Chicago area have proved to be *dorsalis*, and these specimens come well within the range of variation of reared series from nearby localities.

Only a few colonies of *dorsalis* have been found in the state, and all have been associated with waters contaminated by industrial wastes. In southern Illinois, one colony occurred with *solicitans* in saline water from oil wells, and in northern Illinois other colonies were in the seepage areas from several factories. The species is an irregular, intermittent breeder, and usually a brood of adults emerges following each inundation by rain of the affected areas.

The adult females are fierce biters and appear to be predominantly crepuscular.

**Illinois Records.**—Larvae, collected April 22 to May 9, and adults, collected April 9 to



October 10, are from Cahokia (USPHS), Camp Grant (USPHS), Chanute Field (USPHS), Dupu, East Moline, East St. Louis, Great Lakes Naval Training Station, Oak Park, Riverdale, Savanna (USPHS), Scott Field (USPHS), and Summit.

### 17. *Aedes canadensis* Theobald

LARVA.—Fig. 105. Head wide; upper and lower hairs multiple, five to eight branched, similar in length and fanlike appearance to preantennal hairs. Eighth segment with comb somewhat triangular, composed of a large number of small scales. Air tube moderately slender, nearly four times as long as wide; hair tuft long, usually five branched; pecten forming an even row of about 15 teeth, the apical teeth slightly wider apart than the others. Anal segment with sclerotic shield covering only the dorsal half of the segment; anal gills tapering and pointed, about as long as the segment.

FEMALE.—Length of wing 4 mm. Beak and palps brown, the latter with a minute tuft of white scales at extreme tip. Mesonotum uniformly golden brown and with a few indistinct gray lines along lateral margins and on or near scutellum. Dorsum of abdomen dark scaled with an almost uniform narrow band of white scales at base of each segment. Tarsi each with a fairly wide band of white scales at both base and apex, tibiae almost entirely dark scaled, femora mostly white scaled with dorsal portions dark scaled. Wings uniformly bluish-brown scaled.

MALE.—Similar in size, color, and general characters to female, differing chiefly in the long palps, each of which extends beyond the beak and has a large apical brush embracing the last two segments and the apex of the preceding segment. The white bands on the dorsum of the abdomen are much wider than in the female. Genitalia, fig. 140: basistyle with large ovate apical lobes bearing a dense cushion of flattened wide setae, basal lobes wide and triangular, with a uniform brush of very slender setae and a larger single macrochaeta at base; dististyle elongate, with an apical seta; claspette moderately long and stout, with a slender sinuate filament.

This species, which is one of the most widespread in the state, has only one generation per year. The larvae mature early in

the season; the adults emerge in April and May. The species frequents chiefly woodland pools, especially those flooded by seepage water in the spring independent of high water in the streams. In southern Illinois, it occurs primarily in the post oak flats along the Mississippi. In other parts of the state it is found in stump holes, small sink holes, and isolated oxbows of small woodland streams. In rare instances it is found in practically unshaded situations.

The females are fierce biters and attack readily in shaded situations through most of the day. They live for many months, and, in woodland situations, isolated specimens are encountered well into the summer. To date the species has not been incriminated as a carrier of disease.

Illinois Records.—Larvae, collected March 18 to May 23, and many males and females, collected April 11 to August 1, are from Alpha, Altamont, Antioch, Bensenville, Benton, Cache, Camp Grant (USPHS), Carbondale, Carterville (USPHS), Casey, Centralia (USPHS), Cottage Grove, Crab Orchard Lake (USPHS), Danville, Darwin, Des Plaines, Effingham, Elgin, Elk Grove, Equality, Giant City State Park, Glencoe, Golconda, Gorham, Grand Tower, Grantsburg, Grimsby, Halfday, Herod, Ina, Johnston City (USPHS), Jonesboro, Kankakee, Karnak, La Rue, Marion, Mascoutah, Momence, Mount Vernon, Muncie, Oakwood, Raven, Ravinia, Reynoldsville, Rondout, St. Jacob, Salem, Scott Field (USPHS), Springfield, Starved Rock State Park, Urbana, Utica, Vienna, Volo, Wadsworth, Waltersburg, Ware, Waterloo, Wauconda, West Vienna, Willow Springs, Yorkville, and Zion.

### 18. *Aedes sticticus* (Meigen)

LARVA.—Fig. 107. Length 8 mm. Head with upper and lower hairs of only moderate length, usually two to four branched but occasionally with an odd hair single, the exact combination of branching extremely variable and frequently asymmetrical; lower head hairs almost directly anterior to upper hairs. Eighth segment with comb triangular, composed of small scales. Air tube fairly short, about two and one-half times as long as wide; hair tuft short, usually six branched; pecten with 15 to 20 teeth arranged in a close, evenly spaced row. Anal segment with sclerotic plate covering about three-fourths of segment; anal gills tapering and pointed, about as long as anal segment.



FEMALE.—Length of wing 4 mm. Beak and palps black, the beak with a small group of gray scales at apex; dorsum of head gray scaled. Mesonotum, fig. 116, with a broad mesal brown band extending from anterior margin to scutellum and divided down the meson by a very narrow line of gray scales; lateral bands of mesonotum and scutellar region gray; supplemental short brown bands are usually present on the posterior half of the lateral areas, these bands always short and separated from the mesal band by at least a definite line of gray scales. Dorsum of abdomen definitely banded, the apical two-thirds of most of the segments dark scaled, the basal third white scaled. Femora, fig. 125, mostly white scaled, the dorsal edge and apical portion of each black scaled; tibiae usually with upper and lower margins black scaled, sides predominantly pale scaled; tarsi predominantly black scaled, without banding, the posterior basitarsus with white scales often extending as irregular lines from base to near apex. Wings predominantly black scaled, the costal and subcostal areas frequently with many white scales mixed with the black ones.

MALE.—Size and general color as for female. Genitalia, fig. 148; basistyle with very large projecting apical lobe, which bears along its mesal edge a series of setae curved dorsad; basal lobe forming a triangular flap markedly detached from basistyle and connected with it chiefly by membranous folds, with a macrochaeta at extreme base, and with the apical portion curved and bearing fairly stout setae. Claspette slender, with a short apical filament that is expanded near base.

Holarctic in range, this species in North America is widely distributed from coast to coast. In much of the recent literature it has been called *hirsuteron* (Theobald) in the East and *aldrichi* Dyar & Knab in the West. Dr. Alan Stone writes me that he believes these two are the same species and should be considered under the name *sticticus*. Edwards (1932) has synonymized *aldrichi* with *lateralis* (Meigen). Dr. Stone writes that there is some doubt as to the identity of *lateralis* and believes it prudent to use *sticticus* for the species.

In Illinois *sticticus* is extremely common along the flood plains of the larger rivers, where it breeds in flood pools. At times individuals of the species appear in great swarms, and the females are ferocious biters

during the evening and also during the day in cloudy or shaded situations. Emergence of the adults occurs once a year, in early spring. The larvae seem to require shaded pools for development.

Illinois Records.—Larvae, collected April 3 to August 18, and many males and females, collected April 6 to October 25, are from Alto Pass, Belleville (USPHS), Billett, Bishop, Cache, Cahokia (USPHS), Cairo, Calvin, Camp Grant (USPHS), Carbondale, Carterville (USPHS), Casey, Caseyville, Charleston, Clinton, Crab Orchard Lake (USPHS), East St. Louis, Edwardsville, Fox Ridge State Park, Fulton, George Field (USPHS), Glencoe, Golconda, Gorham, Grafton (USPHS), Grand Tower, Granite City (USPHS), Grantsburg, Grayville (USPHS), Great Lakes Naval Training Station, Halfday, Havana, Herod, Homer, Hurst, Inman, Joetta, Johnston City (USPHS), Kankakee, Kappa, Karnak, Keensburg, Keithsburg, Lake Fork, La Rue, Lawrenceville (USPHS), Mascoutah, Matanzas Bay, Mokena, Mount Carmel, Mount Vernon, (USPHS), New Boston, New Haven, Oakwood, Palestine, Palisades, Patton, Pere Marquette State Park, Pike, Pingree Grove, Prophetstown, Polaski, Ravinia, Reynoldsville, Ridge Lake, Rising Sun, Rockford, Russellville, St. Jacob, Savanna (USPHS), Scott Field (USPHS), Shawneetown, Springfield (USPHS), Starved Rock State Park, Tamaroa, Urbana, Utica, Ware, West Vincennes, Willow Springs, Wolf Lake, and Zion.

### 19. *Aedes spencerii* (Theobald)

LARVA.—Length 8 mm. Head wide, both upper and lower head hairs almost always single but occasionally one of them double. Terminal segments very similar to those of *vexans*, fig. 102. Air tube scarcely more than two and one-half times as long as wide; pecten with apical two or three teeth markedly detached; ventral tuft short and beyond pecten. Lateral comb consisting of about 10 to 12 scales arranged in a regular single or double row. Anal segment, fig. 110B, almost completely ringed by dorsal plate, with only a narrow, V-shaped area of membrane between the ventral edges of the plate, bearing one or two ventral hair tufts anterior to apical mesal barred areas; gills tapering, longer than segment.

FEMALE.—Length of wing 5 mm. Color of beak, head, mesonotum, and legs similar to color of corresponding parts of *sticticus*. Each segment of dorsum of abdomen, fig. 117, with a median stripe of white scales, an apical band of white scales, and a nar-

row basal band of white scales, the center of the lateral area being dark scaled. In very light specimens the dorsum of the abdomen may be almost entirely white scaled. Wings predominantly dark scaled but with many of the anterior veins mostly pale scaled, especially toward the base.

MALE.—Similar in general to the female but with the abdomen darker; in dark extremes the first four segments may be almost entirely dark scaled. Male genitalia, fig. 149, similar in general to those of *sticticus*, with the following differences: apical lobe of basistyle more diagonal and longer; apical filament of claspette with a small but pronounced notch at the base of the apical filament.

We have only a single Illinois record of this species, from Savanna, June 19, 1942, in light trap (USPHS). The species is reported to be widespread and abundant in the Great Plains region. The larvae have been taken in temporary rain pools and marshes in Minnesota (Owen 1937).

## 20. *Aedes dupreei* (Coquillett)

LARVA.—Fig. 111. Head wide, with upper and lower hairs long, the upper hairs usually single, the lower ones double and situated almost directly anterior to upper ones; the species is unique in having the latero-dorsal hair of the frons branched. Eighth segment with a comb consisting of an even row of about six long teeth. Air tube only relatively long but narrow and tapering at apex, nearly four times as long as wide; hair tuft long, about six branched, situated before middle of siphon but beyond end of pecten; pecten consisting of an even row of few large teeth. Anal segment completely ringed by sclerotic shield; anal gills extremely long, over twice length of air tube, each gill containing a distinct trachea.

FEMALE.—Length of wing 2.5 mm. Beak and palps black, dorsum of head white scaled. Mesonotum with a wide silver stripe extending its entire length, the lateral area dark brown, abdomen entirely dark scaled. Legs almost entirely black scaled, except for the inner faces of the front and middle femora and all but the apexes of the hind femora. Wings entirely dark scaled.

MALE.—Size and color as for female. Male genitalia, fig. 147: basistyle with projecting and sharp apical lobe that bears only isolated short setae; basal lobe somewhat

ovate, detached from basistyle, connected with it chiefly by membranous folds and by a short sclerotized bridge on which arises the macrochaeta. Claspette slender, its apical filament curved and saber shaped.

We have only one record of the species from Illinois, a series of four females from Ware, August 14, 1942, Ross & Mohr. The specimens were collected as pupae from a temporary rain pool in the post oak flats along the Mississippi River. The species is predominantly southern and southeastern in distribution, and the Illinois record is the one farthest north.

## 21. *Aedes fulvus pallens* E. S. Ross

LARVA.—Fig. 95. Head wide; upper head hairs long and single, lower ones long and double, situated as far anterior to the upper ones as half the distance between the upper hairs; between the lower hairs are a pair of very fine, branched hairs; preantennal hairs short and multiple. Thorax unique among the Illinois species in having the three lateral meso-thoracic tufts each 15 to 20 branched and relatively stout. Eighth segment with comb triangular, composed of about 30 small scales. Air tube short and tapering, stout, only twice as long as wide; ventral tuft large with about 14 filaments, situated ventrad of the pecten and considerably before its apex; pecten consisting of about 15 teeth, of which the 1 to 3 apical teeth are long, large, and well separated, the remainder small and forming a close row. Anal segment completely ringed with sclerotized dorsal shield; anal gills long and tapering, nearly twice as long as air tube.

FEMALE.—Length of wing 5.5 mm. Integument of almost entire body bright golden yellow except for a dark brown rectangle at each postero-lateral corner of the mesonotum, irregular dark brown areas at the ends of the abdominal tergites, and the almost black antennae. Body with conspicuous long slender hairs. Beak and palps yellow scaled, the extreme apex of both tipped with black scales. Mesonotum with scales of the ground color, very thin and scarcely wider than short setae. Abdomen with dorsum predominantly yellow scaled, the apex of each segment with a band of black scales. Legs yellow scaled, the knees and apical tarsal segments black scaled. Wings predominantly yellow scaled.

**MALE.**—Similar in size and color to female. Genitalia, fig. 143: basistyle with projecting and pointed apical lobe that continues basad to beyond the middle of the basistyle and ends in a low but definite shoulder; basal lobe completely detached from basistyle and joined to it by membranous folds, its macrochaeta appearing as a part of the basistyle proper rather than a part of the basal lobe; macrochaeta very long, flattened, widened at apex, and arising from a straplike internal thickening of the integument; basal lobe with slender setae. Claspette with base slender, its apical filament beyond the short neck abruptly enlarged to form a wide blade.

Our Illinois specimens belong to the subspecies *pallens*. It and its relatives have been treated in considerable detail by E. S. Ross (1943).

We have only two records for this species from Illinois, both from the southern quarter of the state (Ware and Mount Carmel). In addition, there is in the Chicago Natural History Museum a specimen from Hessville, Indiana, which is only a few miles from Chicago. This last specimen, which is a female, may have been carried to Hessville from Illinois or states farther south by rail or other transportation. The Mount Carmel specimen, a male collected in 1906, would seem to indicate that at least one colony existed in southern Illinois at that time. The Ware record consisted of four larvae collected August 14, 1942, Ross & Mohr, from a rain pool in the post oak flats; two of the larvae were reared, and males emerged. The species is primarily southeastern, and the Illinois records are apparently on the northwestern edge of its range.

The female from Hessville, Indiana, was recorded by Gerhard (1910) as *Aedes bimaculatus* (Coquillett), and the male from Mount Carmel, collected June 30, 1906, was recorded by Matheson (1930) as *Aedes cataphylla* Dyar.

## 22. *Aedes implacabilis* (Walker)

**LARVA.**—Fig. 106. Head relatively wide; upper and lower hairs very long, usually single, sometimes double, the lower hairs almost directly anterior to the upper hairs and without accessory hairs between them. Eighth segment with comb consisting of an arcuate row of five to seven teeth. Air tube

of moderate length, slightly more than three times as long as wide; lateral tuft very long and stout, usually with four filaments; pecten short, with about 15 teeth that usually form an even row in which the apical ones become slightly more separated. In some cases the apical one or two teeth may be definitely detached from the row. Anal segment completely circled by its sclerite; anal gills moderately long, tapering, and sharp.

**FEMALE.**—Length of wing 5 mm. Beak and palps black scaled. Dorsum of head and mesonotum tawny or golden scaled, the mesonotum frequently with a wide mesal band of reddish-brown scales. Abdomen with dorsum dark scaled, each segment with a basal band of white scales, the bands narrow at the base of the abdomen and becoming progressively larger toward apex. Legs with femora mostly pale scaled, tibiae pale with a mixture of dark scales, the tarsi predominantly dark scaled, without banding.

**MALE.**—Similar in size and color to female. Palps with a large apical brush. Genitalia, fig. 158: basistyle with a large ovate apical lobe, clothed with a cluster of fairly short setae, all pointing dorsad; basal lobe with ventral aspect forming a definite shelflike projection, the setae abundant and confined primarily to mesal aspect, macrochaeta single and moderately inconspicuous. Claspette with curved base, its filament narrow and angled, thickest at the angle.

Formerly known under the name *abseratus* Felt & Young, this species occurs in great numbers in a tamarack bog near Volo and in lesser numbers in neighboring bogs in the northeastern corner of the state. The larvae live in the sphagnum mat of shaded pools. In the bog at Volo such pools occur in the tamarack and poison sumac belt a few paces back from the open edge of the bog and contain no other mosquitoes except occasional colonies of *cinereus*.

Our Illinois records for *implacabilis* appear to be on the southern limit of the range of the species, which is northeastern in distribution. Only a single generation of adults emerges each year, in the late spring. The females are apparently crepuscular and do not bite to any considerable extent during daylight hours, even on days that are cloudy.

**Illinois Records.**—ANTIOCH: May 21, 1941, 2♂; April 23–30, 1942, 2♂, 1♀. VOLO: April 23, 1942, many larvae; April 26, 1942, 7♂, 2♀; May 3, 1942, 1♂; May 13, 1942, Ross,



Burks, & Mohr, 11 specimens, 1 ♀; May 16, 1942, many ♂ and ♀. WAUCONDA: emerged April 27, 1942, 1 ♂.

### 23. *Aedes punctor* (Kirby)

**LARVA.**—Head with the upper and lower hairs usually double. Eighth segment, air tube, and anal segment similar to those of *implacabilis*, differing chiefly in the comb. This has about 12 teeth forming a long irregular row (from Dyar).

**ADULTS.**—In size and general color indistinguishable from *implacabilis* adults. Male genitalia, fig. 156, differing in the following characters: apical lobe with longer and more abundant setae, which are curved dorsad; basal lobe much more massive, the sclerotized portion of the basistyle not extending out onto the lobe, the lobe curved and bearing abundant short setae over its entire surface and a very conspicuous macrochaeta at its basal corner; claspette with apical appendage short, curved, and narrowed at tip.

The only Illinois record of this species is a single male collected as a pupa in a tamarack bog pool at Volo; the adult emerged April 26, 1942. This specimen was collected in a large colony of *implacabilis*. Examination of hundreds of mosquito larvae and males from the locality failed to disclose a second specimen of *punctor*. The habits and distribution of *punctor* are almost identical with those of *implacabilis*.

### 10. *PSOROPHORA*

Robineau-Desvoidy

The females of this genus are fierce biters and the adults in many of the species are diurnal or nearly diurnal in habit. The life history of the genus is very similar to that of *Aedes*. The eggs are laid in damp ground cover and do not hatch until flooded. The larvae mature very rapidly. Larvae of two species are predaceous and feed on other mosquito larvae; larvae of other members of the genus are vegetarian and in the field are easily confused with those of *Aedes*. All species of the group breed intermittently throughout the summer. The larvae frequent temporary rain pools or flooded areas of many types. The adults of one or more species may appear in clouds soon after summer rains. All species hibernate in the egg stage.

The group is essentially southern. The range of the eight species known from Illinois does not extend far north of this state. Three other species of the genus occur within the territorial limits of the United States: *pygmaea* (Theobald) is recorded from southern Florida; *signipennis* (Coquillett) and *longipalpis* Roth occur in the central plains states and southwestward. The larvae are treated by Pratt (1946).

The species of this genus form three very distinct groups, which have been considered as subgenera. It is interesting to note that the female genitalia of all the Illinois species are practically identical.

#### KEY TO SPECIES

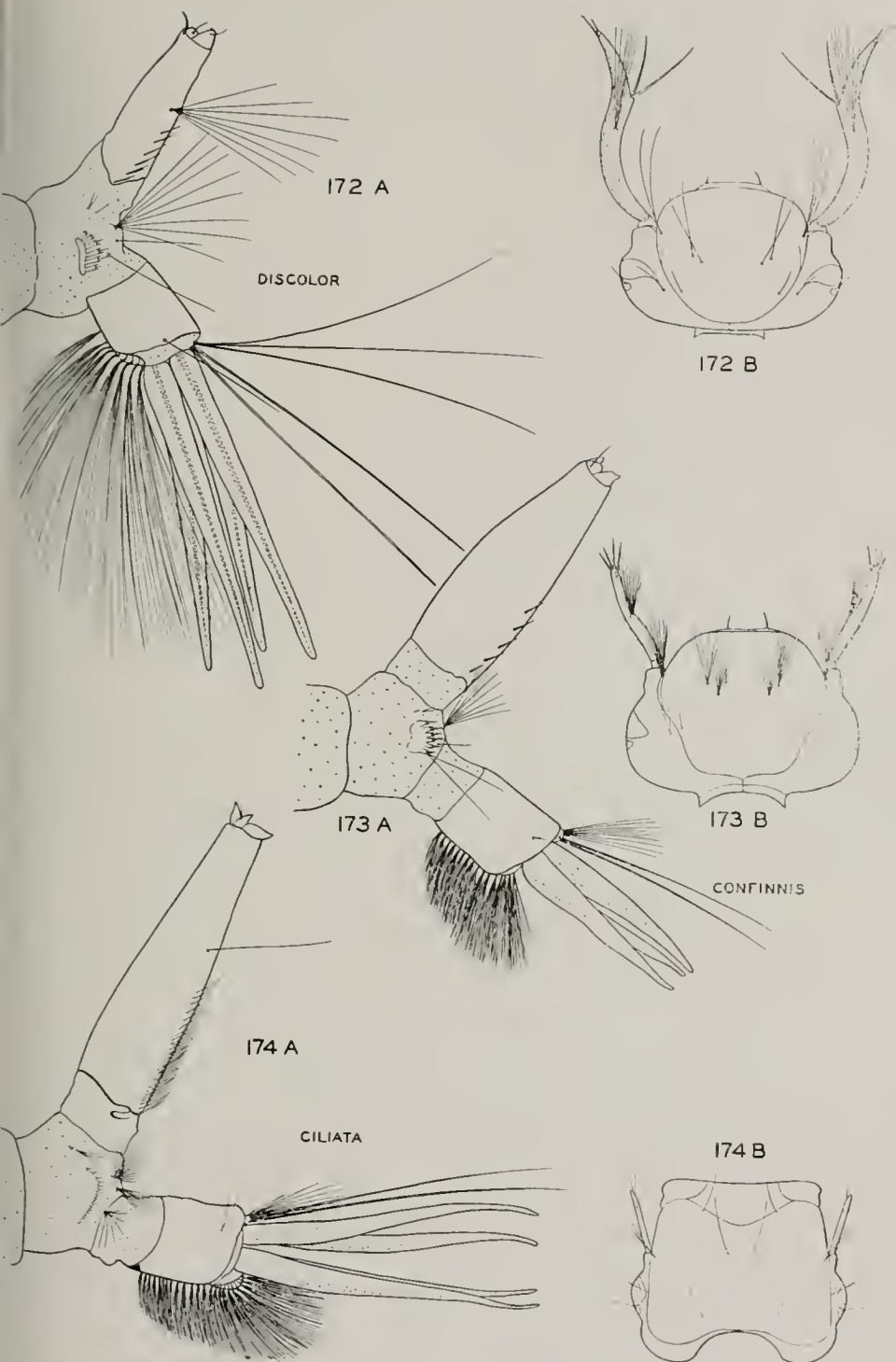
##### LARVAE

1. Head quadrate, antennae short, slender, and without definite tufts, fig. 174; large predaceous larvae.....2
- Head oval, antennae long, stout, and with definite tufts, fig. 173; small to fairly large, bottom feeders.....3
2. Lateral hair of anal segment with two to four branches, separating at base of hair.....1. *ciliata*
- Lateral hair of anal segment single, or forked some distance from base.....2. *howardii*
3. Antennae very large and inflated, air tube small, fig. 172.....8. *discolor*
- Antennae not inflated and air tube large and swollen, fig. 173.....4
4. Upper and lower head hairs multiple.....7. *confinnis*
- Upper head hairs single or double, lower head hairs single to triple.....5
5. Upper and lower head hairs single.....3. *cyanescens*
- Upper and lower head hairs double or triple...4. *ferox*; 6. *varipes*; 5. *horrida*

##### FEMALES

1. Wing length over 6.5 mm., usually 7 to 8 mm.; mesonotum having a narrow mesal band of scales, flanked by a linear bare polished band on each side, fig. 26; hind femora each with a prominent tuft at apex, fig. 28.....2
- Wing length under 5 mm., usually 3.5 to 4.5 mm.; mesonotum with entire area scaled; hind femora sometimes bushy, fig. 30, but not with well-marked tufts.....3
2. Mesonotum with mesal band of scales yellow, hind tibiae and tarsi very bushy.....1. *ciliata*
- Mesonotum with mesal band of scales black, hind tibiae and tarsi pubescent but not unusually bushy.....2. *howardii*





Figs. 172-174.—*Psorophora* larvae: A, apex of abdomen, lateral aspect; B, dorsum of head. Mouth brushes are omitted from head drawings.

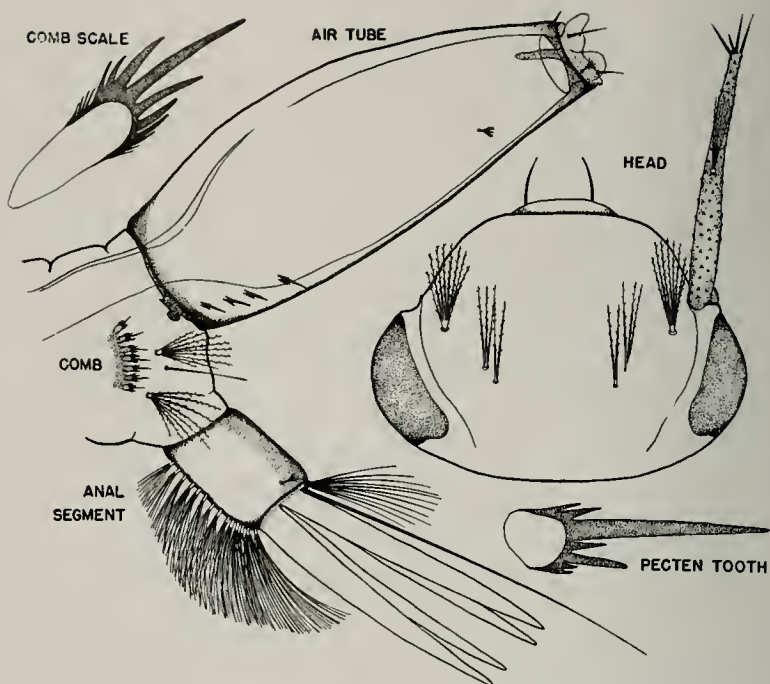


Fig. 175.—*Psorophora horrida*, larval parts. (After Roth.)

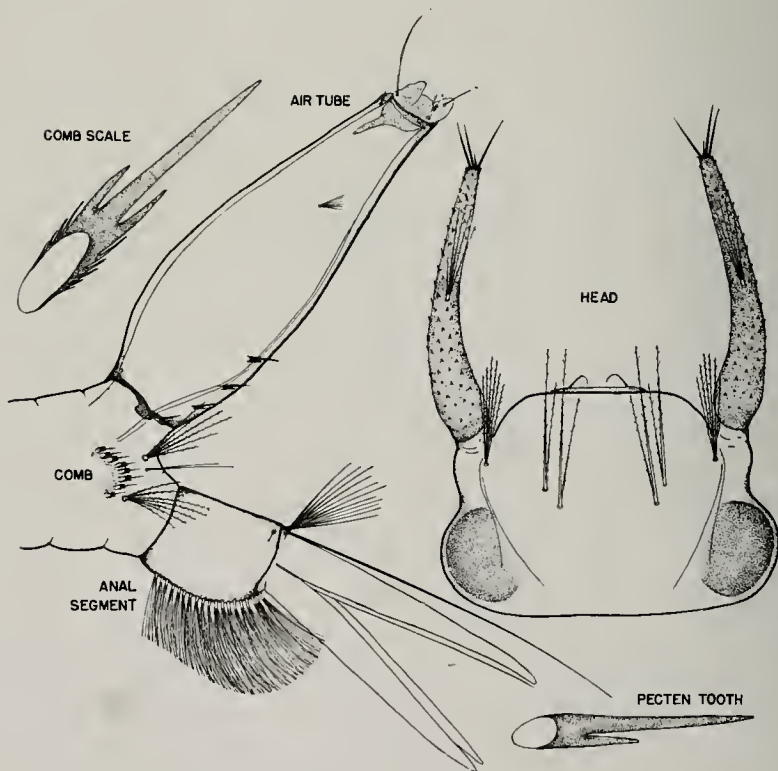


Fig. 176.—*Psorophora longipalpis*, larval parts. (After Roth.)

- 3. Hind tibiae and tarsi entirely purple; abdominal tergites purple, but with apical yellowish bands that are slightly broken on the meson . . . 3. *cyanescens*  
Hind tarsi either with all segments banded with white or with one or more segments all white, or dorsum of abdomen with only small lateral white spots, as in fig. 120 . . . . . 4
- 4. Each tarsal segment with apex dark and base with a white band, as in fig. 28 . . . . . 5

- Each tarsal segment entirely dark or entirely light; a leg may be banded but with an alternation of entirely dark and entirely light segments; rarely one segment may be banded . . . . . 6
- 5. Wings mostly dark scaled but with a fairly even speckling of white scales; hind basitarsus nearly black, with two bright white bands, a narrow one at extreme base and a wider one at middle of segment . . . . . 7. *confinnis*

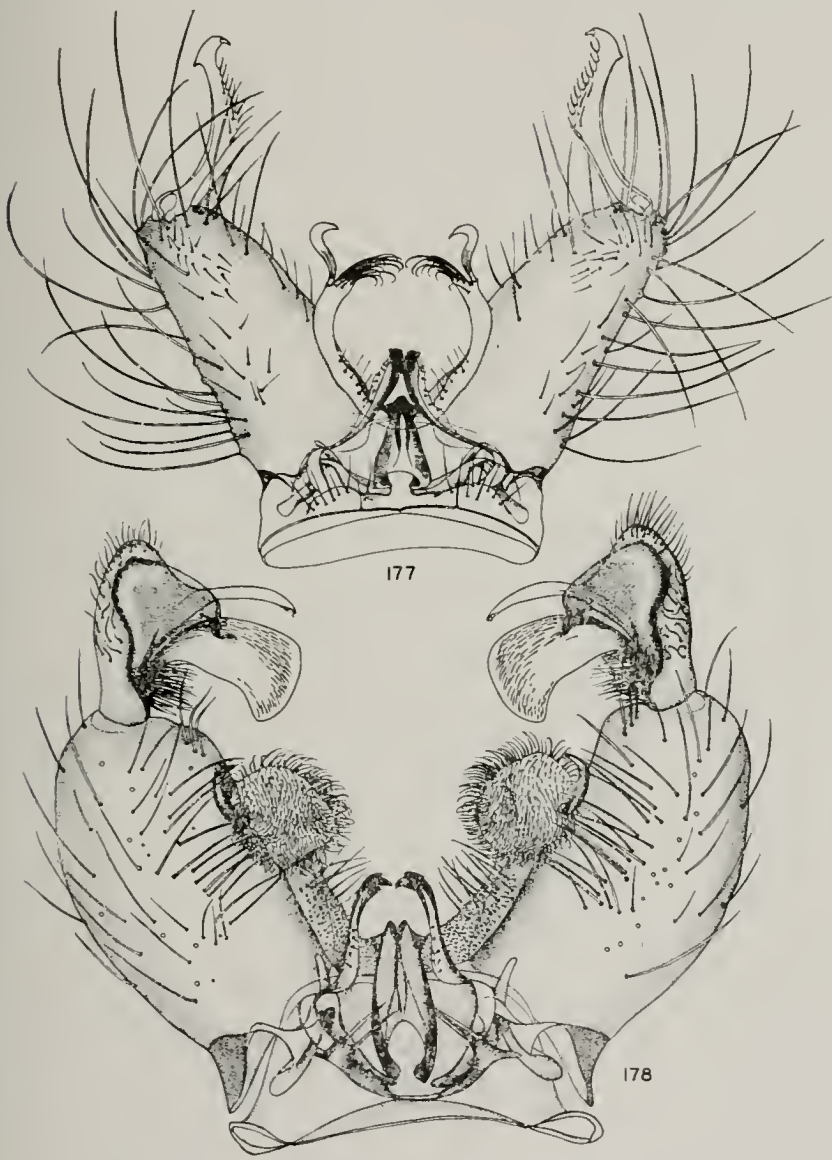


Fig. 177.—*Psorophora ciliata*, male genitalia. (After Matheson.)  
Fig. 178.—*Psorophora howardii*, male genitalia. (After Matheson.)

- Wings with white scales grouped into definite lines or patches on some veins; hind basitarsus mostly white scaled but with dark scales intermingled uniformly along its entire length.....8. *discolor*
6. Mesonotum golden scaled over its entire area.....4. *ferox*
- Mesonotum with mesal half black scaled, lateral fourths white scaled, forming longitudinal bands.....7
7. Hind tarsi having next to last segment white, the remainder black.....6. *varipes*

Hind tarsi having last two or two and one-half segments white, the remainder black.....5. *horrida*

## MALES

1. Dististyle with a large mesal lobe and a long mesal spurlike projection, fig. 178.....2. *howardii*
- Dististyle without mesal processes.....2
2. Dististyle with tip truncate and apical spur situated before apex, fig. 180.....6. *varipes*
- Dististyle with tip tapered and small, apical spur situated at end, fig. 179...3

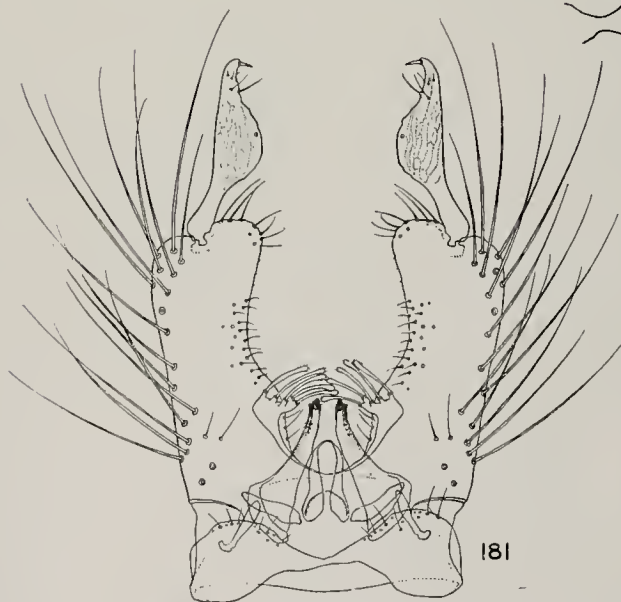
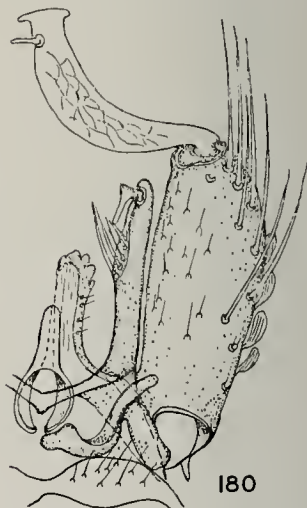


Fig. 179.—*Psorophora cyanescens*, male genitalia. (After Matheson.)

Fig. 180.—*Psorophora varipes*, male genitalia. (After Matheson.)

Fig. 181.—*Psorophora confinis*, male genitalia. (After Matheson.)

Fig. 182.—*Psorophora discolor*, male genitalia. (After Matheson.)



3. Dististyle narrow and sinuate, with a mesal row of bristles and a sharp subapical ventral tooth, fig. 177. . . . .1. *ciliata*  
Dististyle expanded near middle, without mesal row of bristles and without ventral tooth, fig. 181. . . . .4
4. Apex of claspettes with a series of simple setae and two flattened contorted leaflets at lateral corner, fig. 183:1. . . . .4. *ferox*; 5. *horrida*  
Apex of claspettes without contorted leaflets, at most with scales and thickened hairs, figs. 179, 182. . . . .5
5. Apex of claspettes with a dense series of hairs and scales, fig. 179. . . . .3. *cyanescens*  
Apex of claspettes with a series of only four to eight long, thickened hairs, fig. 181. . . . .6
6. Apex of claspettes with four or five thickened hairs, fig. 182. . . . .8. *discolor*  
Apex of claspettes with five to eight thickened hairs, fig. 181. . . . .7. *confinnis*

SYNOPSIS OF SUBGENERA REPRESENTED  
IN ILLINOIS

1. Adults with mesonotum having a pair of longitudinal, pale shining areas on each side of a narrow mesal band of scales; large species, gallinippers. Larvae predaceous, having quadrangular heads and small antennae without tufts, fig. 174. . . . .*Psorophora*  
Adults with mesonotum having a uniform covering of scales; small to moderate size species. Larvae vegetarian, with ovate heads and long, tuft-bearing antennae, fig. 173. . . . .2
2. Palps of male not upturned at end; tarsal claws of female with large subapical

teeth; tibiae and tarsi purple except for a few segments of hind tarsi, which may be white. . . . .*Janthinosoma*  
Palps of male upturned; claws of female without subapical teeth; tibiae with numerous white scales, tarsi having each segment banded with white at base, dark at apex. . . . .*Grabhamia*

Subgenus *Psorophora*  
Robineau-Desvoidy

This subgenus includes two species, *ciliata* and *howardii*.

1. *Psorophora ciliata* (Fabricius)

LARVA.—Fig. 174. Head quadrate, with short slender antennae and only a few inconspicuous hairs. Eighth segment with the comb consisting of an arc of scales arranged along the edge of a slightly sclerotized crescent. Air tube long and moderately robust, tapering to apex, with pecten consisting of scales that are sclerotized at base and hair-like at apex. Anal gills very long.

FEMALE.—Length of wing 7 to 8 mm. Body integument yellowish brown, with the central part of the mesonotum dark brown to almost black; pubescence of many areas not sufficiently dense to obscure the integumental color. Beak and palps with erect, shaggy, dark or tawny scales, dorsum of head covered with white scales. Mesonotum, fig. 26, with a narrow center stripe of white scales, flanked on each side with a pol-

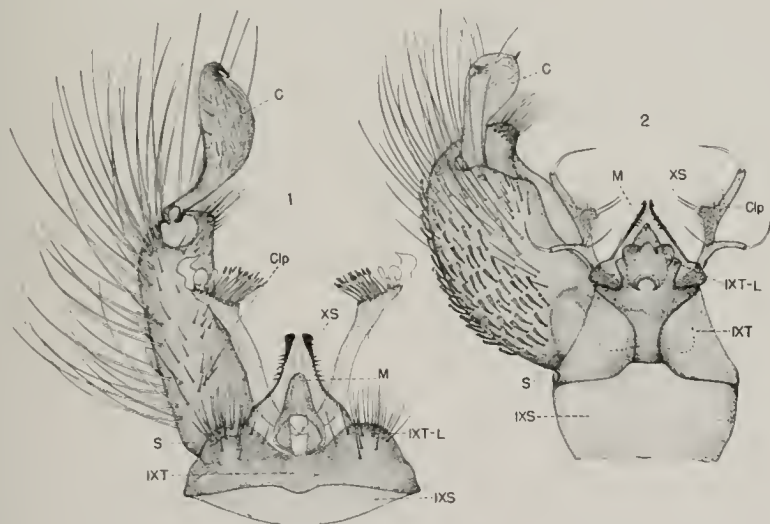


Fig. 183.—*Psorophora*, male genitalia. 1, *P. horrida*; 2, *P. longipalpis*. (After Roth.)

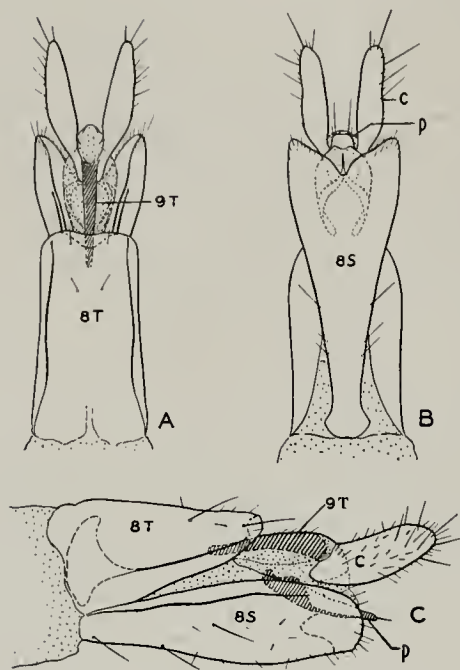


Fig. 184.—*Psorophora ciliata*, female genitalia. A, dorsal aspect; B, ventral aspect; C, lateral aspect. Abbreviations: c, cercus; p, postgenital plate; s, sternite; t, tergite.

ished pale stripe. Laterad of this is a narrow stripe of hairs and black scales and laterad of this is a large area clothed with white scales. Abdomen chiefly tawny or white scaled. Apical fifth of femora and all hind tibiae and tarsi very shaggy, with erect black scales; extreme base of each hind tibia and basal fourth or fifth of each tarsal segment with a band of appressed white scales. Front and middle tibiae and tarsi yellow, not shaggy. Wings dark scaled and usually inconspicuous.

**MALE.**—Similar in size, color, and general structure to female. Palps very long, much longer than beak, the apical three segments with a very large, extensive shaggy brush. Male genitalia, fig. 177: dististyle sinuate and narrow, bearing a mesal brush of bristles and a dorsal triangular projection near apex; claspettes long, free from basistyle, the apex of each with a row of thickened hairs and with a flattened sinuate leaflet on lateral corner.

This species is of unusual interest because it is one of the few whose larvae are predaceous on other mosquito larvae. The big

*ciliata* larvae, which breed in rain pools, usually with large numbers of *Aedes vexans* and with other species of *Psorophora*, move about among the other larvae and cause no commotion. When hungry, a *ciliata* larva simply makes a grab with its mouthparts and mouthbrushes for one of the smaller larvae (it seldom misses) and gradually maneuvers it so that, with the head or tail in its mouth, it can swallow its victim whole. In actions and habits in securing prey, *ciliata* larvae are almost the exact counterparts of the gars among the fish. Usually a full grown *ciliata* larva will consume three or four other larvae per day. In spite of their large size, *ciliata* larvae mature as rapidly as the smaller species.

The *ciliata* females are vicious biters. After a blood meal, they are almost a terrifying sight, due to their large size and business-like appearance. They attack on cloudy days as well as during the evenings. The larvae, which breed in a wide variety of rain pools, are not frequently encountered, but in this state are generally associated with *Aedes vexans*.

Widely distributed from Central America through the central and eastern states to southeastern Canada, the species occurs generally over Illinois. It was recorded from Chicago by Gerhard (1910) and from Urbana by Matheson (1930).

**Illinois Records.**—Larvae, collected May 25 to September 8, and many males and females, collected May 29 to October 21, are from Algonquin, Beach, Beardstown, Bement, Bishop, Bridgewater, Cahokia (USPHS), Camp Grant (USPHS), Carbondale (USPHS), Carterville (USPHS), Cave-in-Rock, Champaign, Chebanse, Chicago, Crab Orchard Lake (USPHS), Downs, East St. Louis, Fountain Bluff, Gorham, Grafton (USPHS), Grand Tower, Granite City (USPHS), Great Lakes Naval Training Station, Havana, Homer Park, Marion (USPHS), New Holland, Newton, Oregon, Pingree Grove, Rockford, Savanna (USPHS), Scott Field (USPHS), Thompson's Lake, Urbana, Ware, West Vienna, and Zion.

## 2. *Psorophora howardii* Coquillett

**LARVA.**—Almost identical with that of *ciliata*. The only reliable difference found to date is the single or split condition of the lateral hair of the anal segment (this hair is branched from base in *ciliata*).

**FEMALE.**—Similar to *ciliata* female in size, general color, and characteristics. It differs

chiefly in having the mesal stripe of the mesonotum composed of black scales, and in having the hind tibiae and tarsi yellow and only moderately spiny; identical to *ciliata* female in appearance of the front and middle legs.

MALE.—Similar to female in size and color. Palps very long, the apical brush represented by short scattered hairs. Genitalia, fig. 178, of striking appearance; claspette ending in an ovate hairy lobe; dististyle with a large, long flaplike mesal projection, the inner apical corner prolonged into a long slender beak.

This species has a wide distribution that embraces the Neotropical region and most of the southern part of the United States. It has been taken several times in southern Illinois and occasionally in central Illinois. The records for this state apparently represent the northern limit of the species range. The larvae have been reared from pools in woodlands and from pools in ruts through a pasture. In the latter case they occurred together with *Psorophora ciliata* and *Aedes vexans*. In southern Illinois they were taken, in company with *vexans* and *P. ferox*, in woodland pools in the post oak flats of the Mississippi River valley. The species has never been found abundantly in the state.

Illinois Records.—Larvae, collected June 9 to August 14, and adults, collected May 26 to September 16, are from Cahokia (USPHS), Carterville (USPHS), Chanute Field (USPHS), Crab Orchard Lake (USPHS), Goreville, Gorham, Grand Tower, New Athens, Scott Field (USPHS), Springfield, and Ware.

#### Subgenus *Janthinosoma* Arribáizaga

The species of this subgenus are conspicuous by the purple iridescent areas on the abdomen and legs, and the purplish cast on many parts of the body, such as the palps and wing scales.

Females of all the species in the subgenus are vicious biters.

### 3. *Psorophora cyanescens* (Coquillett)

LARVA.—(From Matheson 1944.) Head oval, upper and lower head hairs single and long, antennae stout and cylindrical, each with two- or three-haired tuft near middle. Eighth segment with lateral comb consisting of three or four stout scales on a small

sclerotized area. Air tube swollen, about three times as long as wide; pecten with three or four teeth. Anal gills slender, very long and pointed.

FEMALE.—Length of wing 4.5 mm. Beak and palps black or purplish. Integument of head and thorax dull black. Dorsum of head and entire mesonotum covered with whitish scales. Dorsum of abdomen with segments purple scaled except for an apical band of white scales, the band of the apical segments interrupted on the meson. Legs with femora almost entirely yellow; extreme apexes of femora and all the tibiae and tarsi purple; extreme tips of femora each with a small whitish knee spot. Legs purple scaled, the scales inconspicuous.

MALE.—Genitalia as in fig. 179: dististyle sinuate, expanded at middle; claspettes free from basistyle only near apex; apical margin of claspettes with a dense row of hair and scales and with a long curved spine on the lateral corner.

Adults of this species have been taken in numbers in southern Illinois but to date we have found no larvae. The adults are very unusual in many of their habits. They attack during the day and seem to prefer bright sunlight. Extremely rapid fliers, they make a high-pitched sound somewhat resembling that of a humming bird. They are wary and circle a prospective victim before alighting. We found it necessary to let them get a good start at biting before we could bottle them with certainty. On one occasion Dr. Carl O. Mohr and I encountered a flight of adults at West Vienna. When we stepped into the bright sun, the *cyanescens* females attacked quite readily. When we retired into nearby shade, we were not molested. We repeated this action several times and always with the same results. A single female of this species makes so much noise that it can be heard approaching for several yards.

As in other members of the genus, the larvae are reported to breed in rain pools of various types.

Like *howardii*, this species extends its range from the Neotropical region into the southern and central states. It has been recorded from states as far north as Oklahoma, Kansas, and Illinois.

Illinois Records.—Adults, collected May 21 to September 15, are from Carterville (USPHS), Crab Orchard Lake (USPHS), East St. Louis, French Village (USPHS), Granite City (USPHS),



Marion (USPHS), New Holland, Savanna (USPHS), Scott Field (USPHS), Ware, and West Vienna.

#### 4. *Psorophora ferox* (Humboldt)

LARVA.—Head ovate, antennae elongate, with a multiple tuft near middle, upper and lower head hairs double. Eighth segment with a comb of six or seven scales arranged along the edge of an indistinct sclerite. Air tube stout, expanded, about three times as long as wide; pecten of three or four stout teeth.

FEMALE.—Length of wing 4.5 to 5.0 mm. Integument of head yellowish brown, mesonotum almost black. Beak and palps covered with purplish scales. Dorsum of head and pronotum with a uniform but not close covering of whitish or yellowish scales. Dorsum of abdomen purple with lateral white spots visible on segments 4 to 7. Legs with femora yellow, the apical and upper areas purple; tibiae and tarsi purple except for the last two or two and one-half segments of the hind tarsi, which are white; tip of femora with small white knee spots. Wings purplish-brown scaled.

MALE.—Similar to female in size and color. Palps elongate, with only a sparse brush at apex. Male genitalia with dististyle considerably expanded and leaflike, claspettes with a long base, entirely free from basistyle, and with their apices ornamented with a row of setae and each having two or three contorted leaflets on lateral corner; very similar to genitalia of *horrida* (fig. 183:1). To date, no very satisfactory characters have been found to separate the two species on genitalia. The color markings given in the key to females are much more trustworthy.

Common in many parts of Illinois, this species is frequently a real pest. The females are fierce biters and attack readily during the day in shady situations. The larvae breed most abundantly in flood pools, and in stream or river valleys. The first generation of adults emerges early in the season, usually about the middle of May or shortly afterward, and successive generations are on the wing through the summer and well into September.

This species has a wide range from southeastern Canada through the eastern United States into the Neotropical region. In Illi-

nois the species is encountered in much greater abundance in the southern half of the state than northward.

Illinois Records.—Larvae were collected at Karnak, April 29, 1941. Many males and females, collected May 13 to October 14, are from Benson, Cahokia (USPHS), Carbondale (USPHS), Carterville (USPHS), Champaign, Crab Orchard Lake (USPHS), East St. Louis, Elsah, Fort Chartres State Park, Glencoe, Gorham, Gossett, Grand Tower, Grantsburg, Grayville, Havana, Herod, Homer, Karnak, La Rue, Lawrenceville (USPHS), Mascoutah, Momence, Oakwood, Patton, Quincy, St. Jacob, Scott Field (USPHS), Springfield, Urbana, Utica, Vienna, Ware, West Vienna, White Heath, and Wolf Lake.

#### 5. *Psorophora horrida* (Dyar & Knab)

LARVA.—Fig. 175. Very similar to the larvae of *ferox* and *varipes*. To date, reliable and tested characters have not been found to insure correct identification of the larvae of this group of species.

FEMALE.—Length of wing 4.5 mm. Head and thorax nearly black. Palps and beak purple scaled. Dorsum of head white scaled. Mesonotum with mesal third black scaled, lateral third white scaled, these areas forming definite longitudinal bands. Dorsum of abdomen purple scaled with small white patches on some or all of the segments. Femora with basal portions mostly yellow; the apical and dorsal areas are black, and the extreme tip (knee) is white; tibiae and tarsi purple with the exception of the last two segments of the hind tarsi, which are white. Wings purple scaled.

MALE.—Similar in size, color, and general structure to female. Genitalia, fig. 183:1, with dististyle swollen and leaflike; claspettes each with a long stalk, which is free from basistyle, and with apex bearing a row of setae and two contorted leaflets at the lateral corner.

A species of very similar coloration, *longipalpis* Roth (1945a), is distinguished in lacking the white knee spot and also in details of the male genitalia, fig. 183:2. The larva of *longipalpis* differs from that of *horrida* chiefly in details of the chaetotaxy, fig. 176. A species that occurs along the eastern portion of the great plains, *longipalpis* may eventually be found in Illinois.

Very similar in habits and distribution to *ferox*, *horrida* breeds in immense numbers in bottomland pools. It has been taken



abundantly in the southern half of the state and less abundantly in the northern half. The females are vicious biters that attack readily in the daytime.

**Illinois Records.**—Adults, collected May 4 to September 24, are from Camp Grant (USPHS), East St. Louis, Elizabethtown, Fort Chartres State Park, Grantsburg, Havana, Jolietta, Kappa, Karnak, La Rue, Mascoutah, Momence, Mounds, Mount Vernon (USPHS), Oak Park, Patton, Pere Marquette State Park, Quincy, Rockford, St. Jacob, Savanna, Scott Field (USPHS), Seymour, Starved Rock State Park, Urbana, Utica, Warsaw, Wedron, White Heath, White Pines Forest State Park, and Whitesville.

### 6. *Psorophora varipes* (Coquillett)

**LARVA.**—Practically identical with the larvae of *ferox* and *horrida*. To date satisfactory characters have not been found to identify these forms.

**FEMALE.**—Length of wing 4.5 mm. Integument of head and thorax black. Beak and palps purple scaled. Dorsum of head white scaled. Mesonotum with mesal half black scaled, lateral fourth white scaled and forming a conspicuous stripe. Abdomen purple with lateral white spots as in *ferox*. Legs with base of femora yellow, apical and dorsal portions purple; tibiae and tarsi entirely purple with the exception of the fourth tarsal segment of the hind tarsi, which is white; apexes of femora each with a conspicuous knee spot.

**MALE.**—Size, color, and general structure as for female. Male genitalia, fig. 180, with dististyle expanded, broad to apex, apical spine situated just before the tip; claspettes long, free from basistyle, the apex with a row of spines and a foot-shaped leaflet on lateral corner.

This southern species has been taken only in the southern third of Illinois. At times it is abundant in the cypress bottoms, and the larvae probably breed in the summer rain pools of this area. It is a vicious biter and is on the wing as early as the middle of May. No larvae have been taken in our recent survey; habits of the larvae are recorded as being similar to those of other species in the genus.

**Illinois Records.**—Adults, collected April 30 to August 15, are from Cache, Duck Pond Hill, Grand Tower, Grantsburg, Karnak, La Rue, Lawrenceville (USPHS), Patton, Scott Field (USPHS), and Ware.

### Subgenus *Grahamia* Theobald

The members of this group are non-metallic in color and drab in appearance. The scales of the occiput and mesonotum are usually small and well separated. Another characteristic of the subgenus is the mixture of white scales and dark scales on the wing; in some species this mixture develops into a definite pattern.

### 7. *Psorophora confinnis* (Arribáizaga)

**LARVA.**—Fig. 173. Head ovate, wider than long, with long antennae having a multiple tuft near middle; upper and lower head hairs multiple, usually with five or six branches. Eighth segment with comb consisting of about six scales arranged in a crescent. Air tube slightly swollen near middle, tapering near apex; pecten consisting of about four teeth. Anal gills of moderate length, pointed.

**FEMALE.**—Length of wing 4.5 mm. Palps dark-brown scaled with tip white scaled; beak with central half tawny scaled, base brown scaled and apex black scaled. Integument of head and thorax sooty dark brown, nearly black. Dorsum of head tawny scaled. Mesonotum with a mixture of brown and white scales. Dorsum of abdomen dark-brown scaled with apical patches of white scales; on segments 2 and 3, these form a continuous band across the segment and on the segments beyond that they form a pair of lateral areas usually fairly well separated on the meson. Femora predominantly dark-brown scaled and having irregular white scales scattered throughout, with a definite band of white scales just before the apex, fig. 31, and with a prominent small knee spot at apex; tibiae dark-brown scaled with patches of white scales that make a series of dots running down the full length of the segment; tarsi of all legs nearly black, the basitarsus with a very narrow white ring at base and a definite tawny ring at middle, the remaining segments with the basal third or half white. Wings with a fairly even mixture of white scales and dark scales distributed so that no spots or bands result.

**MALE.**—Similar in size, color, and general structure to female. Palps long, the apical two segments and part of the preceding with a long, extensive, and conspicuous brush. Male genitalia, fig. 181: dististyle

expanded and leaflike in middle; claspettes each with short stem and solidly fused to the basistyle; apexes of claspettes each with a row of five to eight thickened hairs.

The larvae of this species breed in temporary rain pools of pastures, farm yards, and other more or less open situations. The females bite fiercely.

Breeding in immense numbers, this species is a scourge in the flooded rice fields of Arkansas and other southern states. In Illinois it is common only in the southern part of the state. It has been taken in small numbers as far north as Chicago. Until recently the name *columbiae* was generally used for this species, and under this name it was recorded in Illinois by Matheson (1930). The species is widely distributed from about the latitude of central Illinois south into the Neotropical region.

**Illinois Records.**—Larvae, collected May 26 to September 16, and many males and females, collected May 27 to October 11, are from Beardstown, Belleville (USPHS), Benson, Cahokia (USPHS), Cairo (USPHS), Carbondale (USPHS), Carterville (USPHS), Champaign, Crab Orchard Lake (USPHS), East St. Louis, Elizabethtown, French Village (USPHS), Grafton (USPHS), Granite City (USPHS), Grand Tower, Havana, Johnston City (USPHS), Marion (USPHS), Mount Vernon (USPHS), Oak Park, Sandoval, Scout Field (USPHS), Springfield, Vienna, Ware, and West Vienna.

### 8. *Psorophora discolor* (Coquillett)

**LARVA.**—Fig. 172. Head broad; antennae very long, thickened, with a multiple dorsal tuft near middle and with two stout spines on venter about two-thirds distance from base; preantennal tuft double and long; upper and lower head hairs single. Eighth segment with a crescentic comb of six scales united by a small sclerotized area. Air tube very short, about as long as width of seventh segment, the tube itself about three times as long as wide, with a pecten of about four or five long scales and with a multiple ventral tuft that is as long as the tube. Anal gills very long, with a trachea extending the full length of each.

**FEMALE.**—Length of wing 3.5 mm. Integument of head and thorax dull, dark gray-brown. Beak with middle half pale scaled, base and apex brown; palps brown with a few white scales at tip. Head with a scattering of brown scales and narrow sil-

very scales. Mesonotum with a mixture of brown scales and silvery gray scales, all of which are small and well separated, giving a stippled effect. Dorsum of abdomen predominantly white scaled, with an irregular mixture of brown scales, the scales normal in size and overlapping. Femora with a mixture of white and brown scales, with a definite preapical band of white scales, and a white knee spot, the area between the preapical band and the knee spot predominantly brown; tibiae chiefly white scaled, with an intermingling of brown scales, especially toward tips; basitarsus white scaled with brown scales predominant toward tip; remaining tarsal segments with basal half white scaled, apex brown to black. Wings predominantly white scaled, with an intermingling of brown scales that form a long irregular blotch near the middle of Costa and many short lines scattered throughout the rest of the wing, giving it an irregular mottled appearance.

**MALE.**—Similar in size, color, and general structure to female. Palps very long, with an extensive conspicuous brush. Male genitalia, fig. 182, almost exactly as in *confinnis* but usually with only four setae at the apex of each claspette.

Adults of *discolor* have frequently been confused with those of *signipennis* (Coquillett), a more western species. The *signipennis* adults may be distinguished by the barlike costal markings in the wings, which are as definite as those in fig. 66.

Occurring through most of the South, this species has been taken westward to Oklahoma and Texas. In Illinois it has been taken chiefly in the southern fourth of the state. It is recorded as biting man, but in Illinois it is not numerous enough to be a pest. The larvae breed in rain pools. The largest colony of larvae we encountered in our Illinois survey was in a weed-choked roadside ditch. The general area was cleared and open, but the ditch was overgrown and heavily shaded with weeds. The larvae were wary and sparse, and some patience was required to gather a series, one larva at a time.

**Illinois Records.**—Larvae, collected June 8 to August 3, and adults, collected May 29 to September 27, are from Cahokia (USPHS), Carterville (USPHS), Crab Orchard Lake (USPHS), East St. Louis, Fort Massac State Park, Grafton (USPHS), Granite City (USPHS), Herrin (USPHS), Marion, Mount Carmel, Mount Vernon, Scott Field, Seneca (USPHS), and Ware.

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